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CONTENTS

	Page
EDITORIAL	221
THE TEACHING OF PHYSIOLOGY TO MEDICAL STUDENTS—By C. H. Best, M.D.	223
MENSTRUATION—By A. W. Ham, M.B., and C. Horner, B.A.	224
AUTOPSIES IN A MEDICO-LEGAL WAY—By W. L. Robinson, M.B.	229
CONTRACEPTION IN ITS MODERN ASPECTS—By D. N. Trimble, B.A., '37	234
BONE TUMOURS—	
PART IV.—OSTEOGENIC SARCOMA—By J. L. Cathie, '37	242
PART V.—MULTIPLE MYELOMA—By W. W. Snelling, '37	245
PART VI.—CONDITIONS SIMULATING BONE TUMOURS—By W. M. McCutcheon, '37	247
GASTRIC CARCINOMA—By A. Feldman, '37	249
PYLEPHLEBITIS AND ITS RELATION TO APPENDICITIS—By D. Levy, '38	256
SOME FACTORS IN CARDIAC OEDEMA—By T. J. Powell, B.A., '39	259
EMBRYOLOGY OF THE URINARY SYSTEM IN MAN—By D. R. Warren, '41	261
BOOK REVIEWS	265
MEDICAL SOCIETY NOTES	267

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Vol. XIV Toronto, April, 1937 No. 6

The local papers of our land have published in recent months charges, court discussions and court decisions relating to the dissemination of knowledge and implements for birth control.

It is of interest to note that similar proceedings have occurred in the courts of the United States since the Comstock Bill was introduced in the Senate and passed with amendment some sixty years ago. The Bill as originally introduced contained the words, "except on a prescription of a physician in good standing, given in good faith." The deletion from the Bill of this phrase by the Senate meant that contraceptives were forbidden whether or not prescribed by physicians.

Section 305 (a) of the Tariff Act of 1930 provided that "All persons are prohibited from importing into the United States from any foreign country . . . any article whatever for the prevention of conception or for causing unlawful abortion . . ."

In actions taken by the United States in cases which have appeared under these Acts, it has not been ruled illegal to import, sell, mail or prescribe things which might intelligently be employed by conscientious and com-

petent physicians for the purpose of saving life or promoting the well-being of their patients.

From all this we gather certain points. The Comstock Bill as finally passed indicates that sixty years ago opinion on the use of contraceptives differed much from that prevalent now. This is representative of the rapid changes that are occurring with regard to social and moral thought to-day.

Laws when passed on moral issues reflect the views of organized religion on these problems. The advance in medical knowledge has made inroads into accepted teachings on many of these questions, but the adoption of such views depends largely upon the progressive nature of religious organizations. We are impressed with the necessity that physicians take a more prominent part in establishing such teachings, especially when topics with such a medical import as contraception and birth control are under discussion.

Legal proceedings are to be avoided if at all possible. In all fairness to the Law it may be said that statutes passed in one age may rapidly become outdated. However, a statute stands until public opinion gains sufficient momentum to change it—usually long after the majority would repeal it, and much longer after minds, just and progressive, bring to the people's notice measures which are not suitable to the thought of the times.

It is encouraging to record the support given the profession by the courts of the people when advances are made in all sincerity and good faith for the betterment of the health and well-being of individuals.

With the closing issue of Volume XIV, the Editorial Staff extends to all best wishes for success in the trials to come.

We thank you for the unusual support and interest in this volume of the Journal. It is hoped that changes that have been made and material published have been in your interests. Some fifty different students have contributed during the year. This is most encouraging, for only by this means can the Journal be of most value to the undergraduate body.

The Dean and Staff of Faculty have been most kind and helpful and we appreciate their support.

To the Advisory Staff the Editorial Board is most grateful for the effort and interest expended on behalf of the Journal and for their valuable counsel.

The Editor wishes to thank all members of the Staff of the Journal for their assistance, co-operation and interest. Through the untiring efforts of Alex. Sturgeon, circulation manager, graduate subscriptions have increased fifty-fold. Much of the success of the Journal is due to the skilled workmanship and fatherly advice and interest of Mr. Avila Paré of the Extension Print.

The Medical Society has seen fit to put Volume XV in the most capable hands of W. G. Bigelow, who as Associate Editor this year has done a splendid job. With J. H. Belton as Associate Editor and V. R. Perry as Managing Editor, the Journal can look forward to its most successful year.

THE TEACHING OF PHYSIOLOGY TO MEDICAL STUDENTS

By C. H. BEST, M.D., D.Sc. Lond.,
PROFESSOR OF PHYSIOLOGY.

In the teaching of physiology it is assumed that the student has mastered many of the basic principles of anatomy, biology, chemistry and physics. The study of the functions of the normal body is extremely difficult without an adequate knowledge of these fundamental subjects. A well-organized Department of Physiology in a Medical School should have a staff capable of teaching some general physiology, chemical physiology, physical physiology (biophysics) and an adequate amount of medical physiology. In this Department there is a section of chemical physiology and a section of biophysics. Five of the senior instructors are qualified in medicine. The objective of the staff in the Department of Physiology, in the teaching of medical students, is to provide auditory and visual stimuli which will promote the absorption and retention, in a readily utilizable form, of the fundamental principles of our subject. The extent to which this objective is attained will obviously depend quite as much upon the student as upon the instructor. While we believe that physiology is a science in its own right, an effort is made to emphasize its dependance on the subjects which have preceded it in the curriculum and the rôle which it plays in the understanding of the problems of clinical medicine.

It will be appreciated that physiology is a very broad subject and that it is, at present, advancing more rapidly than most of those which are taught in the medical curriculum. It is a compliment to the subject that the staffs of many of the other departments are eager to give instruction in what are certainly physiological matters. It would be possible, of course, to break the subject up into many subdivisions. We might have a separate department of general physiology, one of chemical physiology, one of physical physiology and one of applied or medical physiology. It would, however, be difficult for the students to correlate the teaching given in these various departments. It is much better, obviously, to give one course of lectures in which an effort is made to cover, as adequately as possible in the time available, all the various aspects of the subject. In some universities the instruction in both physiology and biochemistry is accomplished by one series of lectures, i.e., the more chemical aspects of physiology are not separated as is the case, in some instances, in our curriculum. The former system has many advantages.

We feel that a step in the right direction has been taken in the teaching of physiology by inviting various members of the Department of Medicine to lecture to the third year medical students. Lectures given by the staff of the Department of Physiology on applied physiology to the students of the sixth year have also, we hope, accomplished a useful purpose. The staff of our department has been enabled to keep more closely in touch with clinical problems through two "liaison officers." One of these spends half of his time in the Hospital for Sick Children and the other half in the Department of Physiology. The second one spends part of his time in the Department of Surgery and the remainder in the Department of Physiology.

In anatomy, pathology and clinical medicine a more or less permanent record of successful demonstrations can be kept and shown to successive classes of medical students. This is more difficult in physiology, but the use of moving pictures is helping to solve some

of these problems. Several very instructive films are shown each year to the students.

In the practical classes an effort is made first to instruct the student in certain physiological technique. Some of the fundamental principles of the subject are excellently illustrated by experiments on frogs and turtles. Later an opportunity is afforded for studies on small mammals and on the intact human organism. It would be easy to plan a more interesting practical course than that which is now given but it is not easy to secure the space, equipment and experimental animals which would be necessary in such a scheme.

MENSTRUATION

By A. W. HAM, M.B., AND C. HORNER, B.A.
FROM DEPT. OF ANATOMY, UNIVERSITY OF TORONTO

The Definition.

Nothing is more provocative of confused discussion than poor definitions. These exist only too frequently in the field of knowledge which concerns the human body and its diseases. The reason for this is that knowledge advances much faster than definitions are revised so that in any field where rapid progress is being made the definitions are apt to be decidedly inadequate. A case in point is menstruation.

Current definitions of menstruation state it to be a bloody discharge from the uterine mucosa of women and the females of certain primates occurring at more or less regular intervals between puberty and the menopause. To this definition are sometimes added two further qualifications, namely, that the discharge must be associated with a loss of endometrial tissue, and that it must come from thick endometrium containing deep, tortuous glands distended with secretion and showing a tendency to develop a decidual reaction in the stroma.

Why the Definition Is Inadequate.

Two developments have made this definition inadequate. The first is the preparation of certain sex hormones with which it is possible to bring about conditions in the uterus of, for instance, a woman past the menopause, or an ovarectomized monkey, which seem to duplicate those which normally occur in the menstrual cycle. Thus all the phenomena associated with menstruation can be artificially produced, more or less at will, either irregularly or outside the time prescribed for menstruation by the definition. Yet these phenomena cannot be termed menstruation by this definition because they do not occur regularly or between puberty and the menopause. Logic dictates that the definition of menstruation should be sufficiently broad to include similar phenomena produced artificially by the use of hormones.

The second way in which the stated definition is inadequate because of recent developments, is its insistence upon the development of a certain histological picture in the endometrium. This characteristic tissue change usually precedes the onset of flow but not always, as it has been shown that monkeys in certain seasons of the year, and sometimes women, experience a phenomenon which clinically cannot be differentiated from menstruation and which occurs in regular cycles at the expected time and yet is not preceded by this characteristic change in the endometrium. This is because this tissue change in the endometrium is caused by the development of a corpus luteum

in the ovary and as a corpus luteum cannot develop unless ovulation occurs and as ovulation does not occur in these cases, there is no reason for the characteristic change to develop in the endometrium. Yet the cyclical haemorrhages continue whether ovulation and corpus luteum formation occur or not. As the underlying cause of the cyclical phenomenon does not seem to depend on either ovulation or corpus luteum formation, and as these events are only usual, but not essential accompaniments to the basic cycle of haemorrhages, it seems unwise to insist that something that is not fundamental to the regular cycle of haemorrhages be the determining factor in deciding whether these regular haemorrhages are menstruation. The development of knowledge of the anovulatory cycle should result in the disposal of the clause which insists upon the development of a special type of endometrium before a regular haemorrhage can be called menstruation.

The Desirability of a Genetic Definition.

All the difficulties caused by the definition of menstruation would disappear if we could frame a genetic one and so define menstrnation by its cause. Then the phenomenon could be properly called menstruation even if it were produced in a rabbit's uterus, by putting the cause into effect. Desirable as a genetic definition would be, it seems questionable if the time is quite ripe for framing one. The problem of menstruation is one of the most complicated ones which are in the process of being unravelled. The significant facts bearing on the problem will now be briefly recounted to see if there is yet a basis for framing a genetic definition.

Sex Cycles in Lower Animals.

It is helpful to begin an investigation into the cause of menstruation by first considering the cycles which occur in the genitalia of the females of lower animals. It is here perhaps that we may get some clue as to the underlying cause of a rhythmic cycle even though that cycle, in the lower animals, does not culminate in menstruation.

Oestrus in the Rat and Mouse.

The name given this periodic recurrence of events in the genitalia of lower animals is the oestrous cycle. In the rat and mouse a complete cycle is repeated every few days and each cycle culminates in the development of the state of oestrus during which the female will mate with the male. In a rat and mouse, ovulation occurs at the time of oestrus, hence copulation at this time is likely to be fertile. Oestrus concerns other things than the willingness to mate, marked histological changes occurring in the uterus and vagina at this time; in the former there is a proliferation and secretion of fluid by the epithelial cells of the endometrium. This results in a distention of the cavity of the uterus with fluid. In the vagina there is a growth and cornification of its lining epithelium.

Cause of Ovulation in Rabbits.

Whereas the rat and mouse ovulate at the time of oestrus the rabbit does not. Once a female attains oestrus, she maintains that state until copulation occurs, and copulation in this case is the stimulus for ovulation. Thus the rabbit is an example of an animal which has if necessary a prolonged state of oestrus and an example of an animal in which copulation is the stimulus for ovulation.

Bleeding in the Cycle of Lower Animals.

The oestrous cycles of the cat, bitch and cow, offers a new point of interest in that bleeding occurs in these animals at a definite point in the cycle. In the bitch this makes its appearance just before the onset of oestrus, in the cow it is slightly later but in all these cases it almost coincides with oestrus.

The Cause of Oestrus.

Oestrus does not occur if the ovaries are removed from an animal. Oestrus can be produced in an ovarectomized animal by injections of oestrin. All the tissue changes characteristic of oestrus can be produced in the ovarectomized animal and Marrian and Parkes have also shown that the mating instinct can be aroused by injecting oestrin into ovarectomized animals although this requires a much larger dose than that which causes the tissue changes.

The tissue changes in the vagina of the mouse constitute a very delicate test for the effect of oestrin and this method is used to assay the hormone. Thus, accepting that a mouse's vagina is an indicator of the amount of hormone in its blood, one must conclude that oestrus is the result of an increase in the oestrin content of the blood.

The Cause of Variations of the Blood Oestrin Level.

As oestrus occurs at the time of ovulation it was incorrectly assumed that the maturing follicle was the source of the heightened blood oestrin which causes oestrus. Thus considerable surprise was occasioned by the fact that Parkes showed that certain animals, the ovaries of which had been treated by X-rays so as to destroy all growing follicles, continued to exhibit regular oestrous cycles. Consequently there is no reason to consider that cyclical variations in the blood oestrin are caused by developing follicles. Another theory has been suggested which proposes that a push-pull arrangement exists between the oestrin output of the ovary and the gonadotropic hormone output of the pituitary. When oestrin output is high the output of the ovary stimulating pituitary hormone falls, then when the oestrin output of the ovary falls from lack of stimulus, the pituitary hormone output is increased only to cause another increased output of oestrin which diminishes again the pituitary output. The phenomenon could be likened to a pendulum which is continually pushed from one side to another.

Pseudo-Pregnancy in Lower Animals and Its Cause.

It has been pointed out previously that ovulation in the lower animals usually occurs at the time of oestrus. After ovulation, a corpus luteum begins to grow in the follicle from which the ovum was extruded. The complete development of this corpus luteum is governed by whether or not pregnancy occurs. If fertile copulation ensued at the time of oestrus and ovulation, the corpus luteum continues growth under the stimulus of pregnancy for a long time. If, however, copulation did not occur at the time of oestrus, or if the copulation was not fertile, the corpus luteum has a different history. In some animals it grows nearly as large and for nearly as long a period as it would if the animal were pregnant. In other animals it grows only for a short time. In all these cases, however, even if it does not survive as long as it would if the animal were pregnant, it (the corpus luteum) through the action of the hormone it elaborates (progestin), produces pregnancy like changes in the animal's body. In some species these are so pronounced that a diagnosis between pseudo and real pregnancy becomes difficult. These pseudo-pregnancy changes are pronounced in the uterus, which increases in size and shows the development of the gravid type of endometrial change. These changes can be produced experimentally by injections of progestin, the hormone of the corpus luteum.

Studies on lower animals therefore provide us with the following facts:

1. Oestrus is caused by an increase in the blood oestrin.

2. This increase is often associated with the maturation of a follicle but is not caused by it; it may be caused because of a push-pull arrangement between the output of oestrin and the output of gonadotropic hormone of the pituitary gland.

3. Bleeding occurs in certain animals at the time of oestrus (time of greatest oestrin effect).

4. In the absence of pregnancy ovulation is followed by a state of pseudo-pregnancy which is caused by the growth of a corpus luteum in the follicle from which the ovum was extruded.

5. Whereas oestrus and variations in the blood oestrin content do not depend upon ovulation, the development of a corpus luteum and pseudo-pregnancy do depend upon ovulation.

The Cycle in the Human.

Examination of the cyclical phenomena in women reveals that only some of these events observed in the lower animals are duplicated. There is, for instance, no definite period of oestrus in women. Ovulation usually occurs about half way between two menstrual periods and there is no special oestrus phenomenon associated with it. Ovulation in women is, however, followed by a period of pseudo-pregnancy just as it is in lower animals. In the absence of the development of true pregnancy, the period of pseudo-pregnancy begins after ovulation and continues until the time of menstruation. It is caused by the development of a corpus luteum in the follicle in the ovary from which the ovum was extruded and it is responsible for the development in the uterus, between ovulation and menstruation, of thick endometrium which contains deep tortuous glands distended with secretion and a decidual type of stroma. Thus the typical picture of premenstrual endometrium is one of the effects of pseudo-pregnancy. Pseudo-pregnancy terminates with menstruation.

Is the Termination of Pseudo-Pregnancy the Cause of Menstruation?

As menstruation ensues at the termination of pseudo-pregnancy it is not illogical to question whether this is not the cause of menstruation. However, the termination of pseudo-pregnancy in lower animals is not accompanied by extensive haemorrhage from the uterus. There may be a few areas of intraendometrial haemorrhage but nothing comparable to the extravasation seen in menstruation. Of still more importance in indicating that the termination of a pseudo-pregnancy is not the cause of menstruation is, however, the fact that not uncommonly in monkeys and uncommonly in women, regular, clinically typical menstrual periods occur without there having been ovulation, corpus luteum formation, or pseudo-pregnancy changes in the endometrium. This cycle which has been studied carefully in monkeys by Corner has been termed the anovulatory menstrual cycle. It indicates beyond question that there is some underlying factor which causes cyclical haemorrhages, and that ovulation, pseudo-pregnancy changes or terminations of pseudo-pregnancies are not necessary for the existence of the regular cycle of haemorrhage experienced by women and monkeys. Thus we conclude that the termination of a pseudo-pregnancy (failure of the corpus luteum) is not the fundamental cause of menstruation.

Is Menstruation Caused by Variations in the Blood Oestrin Content?

We have already reviewed the evidence which shows that oestrus is caused by variations in the blood oestrin level (active oestrin). Furthermore it was shown that bleeding sometimes occurs in lower animals at the time of greatest oestrin effect.

Examination of the cycle in the monkey reveals a curious point of difference. The activity or level of oestrin in the blood of the monkey can be determined by observing an area of skin on that animal which is known as the sexual skin. This becomes red under the influence of oestrin. Menstruation occurs in the monkey not at the time of greatest oestrin activity (as judged by the sexual skin reaction) but after the oestrin content of the blood has

fallen and the sexual skin has assumed its palest colour. Thus menstruation occurs in the monkey at the time of cessation of oestrin action. This has given rise to the theory that menstruation is caused by oestrin deprivation after an animal has been subjected to its effects.

That oestrin deprivation will cause bleeding is also evidenced by other phenomena. Monkeys and humans not uncommonly bleed after both ovaries are removed. Ovarectomized monkeys, receiving oestrin injections frequently bleed when the injections are stopped. Thus there is additional evidence to show that oestrin deprivation causes bleeding.

Attempts have been made to estimate the blood oestrin content at various points in the menstrual cycle of women. Bartelmez has recently suggested that these results cannot yet be accepted because it has been shown that great variation exists in the sensibility of test animals in which the biological assay of the blood oestrin content of women is made. Hence the evidence that menstruation is caused by oestrin deprivation is not yet conclusive.

Does Oestrin Cause Bleeding in Two Ways?

One other point makes the matter confusing. The bitch it was observed, bleeds at the time of greatest oestrin effect (in oestrus). The monkey bleeds at the time of least oestrin effect. Yet monkeys receiving a long course of oestrin injections sometimes bleed in the course of these injections as do humans. Thus oestrin seems to be able to initate bleeding from the endometrium in two ways, either after deprivation, or at a time of great oestrin effect. It is not yet clear that these two types of bleeding are absolutely different from one another. We know that oestrin primarily causes growth and secretion of the epithelium of the uterus. Once it has grown under the effect of oestrin it seems dependent for its welfare upon a continuance of the oestrin stimulus, yet it seems that it cannot respond to that stimulus indefinitely without collapsing. It (endometrium) is not unlike the complex array of articles which a juggler may support, if he withdraws his support it collapses, yet he cannot support it indefinitely. Hence it is bound to collapse one way or another.

Conclusion.

It is now, perhaps, apparent that the cause of menstruation is not definitely known. The best theory seems to be the oestrin deprivation theory, but that is not yet completely proven, and we are not sure of the cause of the variations in blood oestrin content. Hence we are as yet unable to frame a genetic definition for this extremely complicated process and will be in great doubt in the next few years as to whether artificially induced hormone bleeding should be called menstruation or not.

References.

As general references two recent comprehensive reviews are recommended. These are:

1. The Nature of the Menstrual Cycle (Harvey Lecture), by George W. Corner, Medicine, Vol. 12, Page 61. (1933).
2. Menstruation, by G. W. Bartelmez, Physiological Reviews, Vol. 17, Page 28 (1937).

AUTOPSIES IN A MEDICO-LEGAL WAY

By W. L. ROBINSON, B.A., (McM.), M.B., F.R.C.P. (C),
PROFESSOR OF PATHOLOGY

One approaches the performance of a Medico-legal autopsy with a somewhat different frame of mind and technique than for a routine one. I am ever in the habit, while doing a Medico-legal autopsy, of reminding myself that I have to take this particular case into the witness box and be fully prepared to answer a variety of questions put by both prosecuting and defence counsel. My duty to the jury will be to bring to them all the facts and my interpretations thereof. With experience one soon learns the usual lines of defence in the various types of cases. However one cannot foretell them all and so one must be prepared for the unusual as well as the usual ones.

Before proceeding with the examination of the body be sure that the body is properly identified to you. This may be done in an official way by a near relative or friend, in the presence of yourself and a police officer, or you may take it second-hand as it were, from one of those present at the official identification.

Careful inspection of the surface of the body comes first. This must be carried out in good light and the body fully exposed. One must note the general build and development of the individual; muscular development, apparent age, and general nourishment. One also notes all indentifying marks such as tatoo marks, moles, colour of hair, teeth that may be missing, or fillings, etc. In case of suspected hanging or strangulations the marks—produced by a rope or fingers must be very carefully looked for. If the rope marks are present measurements of the indentation produced must be taken. If finger marks are present these should be measured and prints taken if possible. One might go on indefinitely telling you of all the things to look out for but suffice it to say that one must be on the alert for surface markings of all kinds and make a note of them regardless of whether or not at the time one thinks they are important. Many cases take as much time to describe surface markings and lesions as the whole of the rest of the autopsy. If done carefully and completely you will have no worries or regrets when you get in the box.

Superficial bruises and abrasions are of little importance in a routine autopsy whereas in a medical-legal case they hold a prominence much above their seriousness as a cause of death. Much of the pre-mortem story can be reconstructed on them. It is important to note their exact location. For instance in a recent case, because I had measured the height, (from the bottom of the heels), of two bruises on the front of both legs I was able to verify the fact that they were produced by the bumper of a car.

A careful examination for fractures of the extremities must now be made. Do not neglect this. It would be very embarrassing indeed to have the clinician on the case get up in the box and describe a fracture that you hadn't even thought of. You will have no excuse because you had the whole body to examine at your leisure, and with no restrictions.

In the case of stab wounds their exact location is very important and the size and direction of the surface wound must be carefully noted. Next the direction of the wound into the body is very important. I am reminded of a case in which the defense counsel tried to prove that the deceased ran at the defendant and fell on the knife. I was able to show that this was impossible because of the fact that the stab wound penetrated the body from the side towards the centre in such a manner that he would have had to

fall in an almost impossible way to produce the wound. The crux of the case hung on this one bit of evidence.

It is important to note the character of all wounds whether contused or clean cut. When examining a wound make a mental picture of how it might have been produced, what type of object was used; was it blunt, rounded, or sharp? Is it superficial or deep? Was it a direct or a glancing blow? Was it produced by a hard surface or a cushioned one like the first? These are the types of questions one must be prepared to answer.

The internal examination of the body is proceeded with just as one does in a routine examination, although one should never hesitate to alter this routine in unusual cases. For instance, in stab wounds and gun shot wounds of the body, the direction of the wound in the body is most important. First efforts should be directed towards determining this. The exact spot of each organ pierced should be noted so that afterwards the direction of fire or stab can be readily reconstructed. In the case of gun shot wounds the entrance and exit wounds (if any) must be measured and located on the surface of the body. The presence or absence of powder marks is important. A search must be made till all bullets are found and these labelled and not allowed out of your possession until handed directly to the properly qualified person to receive them for further examination. Just here it might be well to urge upon you the importance of not breaking a chain of evidence. Bullets, knives, or specimens should pass through as few hands as possible to reach the expert who is going to make the special examination of them. Make a note in your protocol to whom you delivered the articles and on what date. In the case of traumatic injuries to the body, examine the intestines, mesentery, liver, spleen and kidneys for ruptures and lacerations. Note the amount of blood in the cavities if there is a haemorrhage. Determine where the haemorrhage has come from. Decide there and then, if possible, the force and direction necessary to produce the internal injury you found.

On opening the chest cavities examine all the ribs carefully for fractures and locate them accurately on your diagram of the human body. Look carefully for lacerations of the lungs from the broken ends of the ribs. This is often the cause of death by haemorrhage. The whole spine and pelvic bones are next examined. Cut away the psoas and iliacus muscles to get down to the pelvic bones.

In the case of death from suspected poisoning, one must be on the alert while making the internal examination for unusual odours from the body, such as alcohol, bitter almonds (cyanide), etc. Note whether or not the blood is clotted. In asphyxias the blood does not clot; in carbon monoxide poisoning the formalin preserved material will retain its red colour for two or three days. If suspected alcohol poisoning, or if a question of the sobriety of the deceased is liable to come up in the court, take samples of blood and urine and send them to a properly qualified person to make an analysis for its alcoholic content. It is only recently that this has come to be considered an important test. The results may mean a great deal in the final decision of the case.

Where it seems advisable to have a gastric analysis made, take an ordinary quart sealer and wash it thoroughly with clean water, then empty the stomach contents into it.

In reference to special examinations, over and above the routine examination, authority must be obtained from the Attorney General's department before a special fee will be granted for this work. When that is obtained then one must be careful to deliver the specimens, if possible, directly to the specialists so that the chain of evidence is not broken. Defense counsel is ever on the alert for flaws in the Crown's case.

Traumatic injuries to the skull present a most interesting problem. One should examine the scalp for bruises, swellings, lacerations or contusions and note their exact size and location. Note also the amount of subcutaneous haemorrhage. This will give you some idea of the extent of the surface of the object which produced the injury to the skull. In taking off the calvarium be sure to make your saw cuts completely through the skull so that no undue force is required to remove the skull cap. Sometimes fractures are produced in this way which were not originally there.

One should be very careful in removing the skull cap not to disturb extracerebal haemorrhages more than is necessary. It is well, in describing such haemorrhages, if present, to give their dimensions in inches, or by volume in ounces. Use terms of measurement that the layman will understand. Do not describe haemorrhages as small, moderate or great. Actual measurement is more exact and more readily understood by all. Afterwards, of course, you can explain to the jury whether it was great or small.

Next one removes the brain in the ordinary way and sets it aside till you have completed your examination of the skull. Open all the venous sinuses and look for thrombi. Then, with a towel in your hand, strip off the dura from the skull and look carefully for fractures.

Most fractures have a tendency to run directly from the point of injury on the skull along the line of force which produced that injury. Most fractures run down to the base of the skull. If they start on either side they show a great tendency to run across the base through the sella turcica to the other side. After fractures have all been carefully described and charted out on the diagram the middle ears and nasal sinuses must be opened. No mistake must be made about this. Cases have been lost in court because the doctor failed to open a middle ear or a nasal sinus.

Fractures of the skull in themselves do not cause death. They indicate that a severe blow has been dealt to the cranium. It is the effect of this blow on the brain that we must look for. Whether the brain injury will be directly under the site of the blow to the skull, or contracoup depends, I believe, a great deal on the speed with which the cranium was struck. Fast blows with lighter objects are more liable to produce their effects locally. Slower, more ponderous blows, as by falling to the pavement, are more liable to produce contra-coup injuries to the brain. Such injuries to the brain are usually of the nature of superficial lacerations with haemorrhage beneath the arachnoid membrane or, if more severe, subdural. Intra-cerebal haemorrhages sometime offer a little difficulty in determining their origin. One naturally imagines they are spontaneous. Such is not always the case. Some of them are definitely due to trauma. The location of the haemorrhage and the age of the patient very often help to decide whether it was spontaneous or traumatic in origin. I well remember a difficult case of this type to decide. The man, aged 60 years, came to work in a machine shop and was noted by the door keeper as not looking well. Suddenly, during the morning, he fell down into a small pit, struck his head, fractured his skull and had an intracerebellar haemorrhage. Now did he have the haemorrhage first, then fell and fractured his skull, or did he slip and fall, fracture his skull and produce a traumatic haemorrhage. Because of the location of the haemorrhage, exactly in line with the force producing the fracture, I gave it as my opinion that the haemorrhage was due to the fall not the fall due to the haemorrhage.

In cases of sudden death, where there is no suspicion of foul play, one naturally looks first to the heart and particularly the coronary arteries. One should never neglect to examine these vessels. The best manner of doing so is to cut a series of crossections about

¼ in. apart with a sharp knife down the whole course of both coronaries and their branches. Examine the heart muscle for infarcts. In sudden deaths these are very often hardly recognizable to the naked eye. One can usually, however, feel that the infarcted area is a little softer than normal.

Another cause of sudden death that one should look for is pulmonary embolism. One should always open the pulmonary artery first before removing the heart, and with your finngers feel for thrombi. The pulmonary arteries of the lungs should be carefully opened and examined for thrombi.

Ruptured cerebral aneurysm is another example of a cause for sudden death. This occurs in younger individuals. One finds a more or less diffuse subarachnoid haemorrhage and if you are careful in your dissections of the cerebal vessels, you will be rewarded by the finding of the aneurysm.

Another interesting and tragic example of sudden death is that due to air embolism. I have seen six such cases following an attempted abortion by the injection of antiseptic fluids into the uterine cavity with a Higginson syringe. What usually happens is that the tube and bulb are not filled with the fluid at the start, the result is that the air contained therein is pumped into the uterine cavity and it is blown up like a foot-ball. The placenta then separates and opens up some of the uterine sinuses. The air pressure is much greater than the venous pressure and immediately there is a rush of fine air bubbles into the venous circulation which soon collect in the branches o the pulmonary artery and block the circulation. At autopsy one finds the uterus blown up, the inferior vena cava filled with bubbles of air, the right heart distended with air and the pulmonary artery filled with foamy blood. The left heart is contracted and empty.

These are the most important causes for sudden death, apart from severe traumatic injuries. Other conditions, such as pneumonia, nephritis, etc. of course, will be met with in a medico-legal practice. An example of this is a case I had of a man dying suddenly while at work on the street. At autopsy I found a very extensive lobar pneumonia early gray stage involving both lungs.

Septic abortions represent a most difficult type of case to handle. One has to be extremely careful not to leave any loopholes in the chain of evidence, and at the same time one must be careful not to draw hasty conclusions. After determining the infection, its source and distribution, one must then start to eliminate all other possible sources for that infection. Teeth, tonsils, sinuses, etc., must be all carefully examined. You must be prepared to get up in the box and say that that infection came from the uterus and no other place; and that it must have been introduced into the uterus.

Pregnancy must first be established although this does not alter the nature of the charge. Some years ago I had a case where an abortion was attempted in a non-pregnant woman. The judge intimated that the case was all the more serious for the defence in that in his ignorance he was practicing his deviltry on non-pregnant women. As far as the law is concerned it makes no difference whether the woman is pregnant or not.

The vagina and cervix should be examined most meticulously for evidences of abrasions or lacerations that might have been produced by an instrument. Cultures should be taken from the vagina, uterine cavity, tubes and peritoneal cavity. The uterus should be measured and an estimate made of the duration of the pregnancy.

In preparing for your part in the trial I cannot emphasize too strongly the necessity for thoroughly understanding your case. You must have a clear picture in your mind of all the findings. Then, while you are sitting idly at home, or driving about in your car, keep thinking the case over. Go over in your mind all the possible lines of defense. Take the opposite stand and quiz yourself most severely. Don't

be worried if you stick yourself with your own questions. You are not out to beat anyone. You must admit readily and do not be afraid to say you do not know. Never allow counsel to lead you beyond your own field. Cross examinations are interesting if you are well prepared and if you hold to the one idea—that you are there to "tell the whole truth and nothing but the truth". You are there to neither convict nor defend.

You need not be perturbed by the lawyer with a pile of medical books in front of him. When a text book is handed to you do not accept it unless you really know the book, regardless of how much counsel may eulogize its author and contents. It means nothing to you unless you personally know the book and are prepared to consider the statements printed therein as being in a sense authoratative. If you accept the book as being a well recognized one with which you are familiar, counsel will read from it a passage and ask you whether you agree or disagree with that statement. Now there is no time limit set for a trial so take your time, ask for the book, then read the statement over carefully. Next get the setting. Maybe it is just part of a paragraph or even just part of a sentence which, when read with its proper setting, may sound altogether different. I have been able to throw out a text book statement as being not applicable by showing in a previous sentence that the author was discussing a totally different type of case. This puts the cross examiner on the defense and makes him cautious of further such procedures. In fact, it sometimes means the end of a text book cross examination. I have found that text book examinations, as a rule, are not very disturbing because statements contained therein are never dogmatic if you take the whole text into consideration. Furthermore, it is always your privilege to disagree with the author even if it be an Osler. The jury know you by now and may never have heard of Osler.

One more point, in giving evidence that I have found to be extremely important and one that is so often neglected, is the necessity for thoroughly understanding cousel's question. Frequently they are not well worded and often it is a double barrel question. I do not hesitate to repeat the question or even construct it with the approval of counsel. Then I answer it. Of course it may embarras consel a bit to have you picking his question to bits and asking him for explanations of what he means by such and such. You must help him out if he is in a dilemma in order that there shall be a clear understanding of all the facts.

Finally, in giving your evidence avoid above everything the use of technical terms. Learn the common expressions for clavicles, femurs, aortas, etc. You leave a very bad impression in the court if you are not careful about this. It means that either you are not sure of yourself or that you have a superiority complex. Be careful in this matter and remember you are talking to "twelve good men and true" and they are anxious to know all the true facts of the case. It is for you to give the facts, and honest opinions based thereon. It is for the jury to decide the guilt or innocence of the defendant.

SHOULD COD LIVER OIL BE FLAVORED?

It is a well-known fact that young infants shy at aromatics. Older patients often tire of flavored medications to the point where the flavoring itself becomes repellant. This is particularly true if the flavoring is of a volatile nature or "repeats" hours after being ingested. Physicians have frequently used terms "fresh", "natural", "sweet", and "nutlike" in commenting upon the fine flavor of Mead's Cod Liver Oil. They find that most patients prefer an unflavored oil when it is as pure as Mead's.

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CONTRACEPTION IN ITS MODERN ASPECTS

D. N. TRIMBLE, B.A., '37

It is not the author's purpose in this paper to enter into a prolonged discussion of the legal and moral aspects of contraception or Birth Control. However a few facts relevant to the sociological phase of Birth Control and to the physician's standing regarding the subject at hand must be made. The Birth Control movement is not the result of artificial agitation; rather is it forced upon the minds of women and men by existing conditions, whatever they may be, and neither the prejudices of society nor supression by law can do away with it. Legislation, in its narrow and unscientific attitude, has hampered the dissemination of information on Birth Control, but for all that, the spread of contraceptive methods has not been prevented. They are sold at every drug-store under the mark "For Prevention of Disease", and every time a contraceptive is bought, a silent admission is made either that one of the participants is diseased or that prostitution is to be indulged in. It is a definite responsibility of the medical profession, which influences the masses in the practical application of medicine, that it take the lead in spreading light on reliable and healthful methods of contraception, instead of leaving the way open for contraceptives which are uncertain and detrimental to health. The public must be educated to the idea of obtaining reliable information about contraception from their doctors, and not from any other source. It is high time therefore, that the doctor either becomes an expert in the means and methods of contraception, or knows where to refer patients who come to his office desirous of such information.

One must realize that voluntary parenthood is no panacea for all human evils; it will not solve the problems of mental deficiency, of poverty, or of war, as is claimed by some neo-Malthusian enthusiasts. But it will have a wide scope of influence, and some of the more important changes brought about may be enumerated as follows:

1. The widespread practice of scientific contraception is one of the means at the disposal of the medical profession for dealing with abortion and sepsis, presumably due to interference, the dangers of which are incomparably more serious and frequent than any arising from contraception.
2. It permits early marriages, and often brings about happier sex relations.
3. It preserves woman's health and means the six- to eight-hour day instead of the twelve- to sixteen-hour day which the mother of many children is forced to endure.
4. It will lead to an improvement of existing conditions, if only to lighten the burden on the tax-paying community, for at present only the socially- and financially-favored are able to obtain contraceptive information, resulting in an overwhelming increase in population among the less-favored.

Before one considers the application of contraceptive methods, one should clearly understand what contraception means. Many people confuse prevention of conception with abortion. Contraception means the use of methods which will interfere with the fertilization of the ovum, or in other words, with the formation of the embryo; abortion implies the destruction of the embryo already formed. Thus knowledge of Birth Control is the best method of lowering the number of abortions.

The average woman and man are surprisingly ignorant of the functions of their bodies, especially their sexual organs. They have hardly any concept

of what "contraception" really means. For example, some people believe that urinating after coitus is a good methods of preventing conception; others believe that the woman can prevent conception by refusing to respond to the passion of the man; and still others believe that medicine taken by mouth can prevent conception.

To understand the correct application of contraceptive methods presupposes a fairly detailed knowledge of the male and female sexual organs and the process of conception. The important fact to remember is that the spermatozoa must enter the uterus before conception can occur, and to prevent conception, one must prevent the entrance of spermatozoa into the uterus. This is not considered necessary by the exponents of the Ogina-Knaus 'safe period' theory, as we shall see later.

This paper will outline methods to be used by those desiring fewer children, and will not touch on sterilization, which renders the individual incapable of becoming a parent. In general a good contraceptive should comply with the following conditions:

1. It must prevent the entrance of spermatozoa into the uterus.

2. It must not interfere with the course of normal sex relations, as such interference is likely to lead to nervous upsets detrimental to health.

3. It must be simple enough to be used by the person of average intelligence.

Classification of Contraceptive Methods

A. *Methods used by the man*:
   1. Coitus interruptus.
   2. Coitus reservatus.
   3. Condom or 'safe'.

B. *Methods used by the woman*:
   1. Chemical means, the purpose of which is to destroy the spermatozoa before they can enter the uterus.
      (a) douches;
      (b) suppositories;
      (c) foam tablets;
      (d) jellies.
   2. Mechanical means, the principle of which is to close the external os of the uterus and so prevent the spermatozoa from going deeper than the vagina.
      (a) sponges and tampons;
      (b) cervical caps;
      (c) vaginal diaphragms;
      (d) appliances inserted into the cervical canal and uterus.

A description and method of application of each device will be given, after which a discussion will follow on the contraceptive methods which have been proven most satisfactory.

COITUS INTERRUPTUS

This is the oldest method of conception control, and consists of the withdrawal of the penis from the vagina just before the ejaculation of the seminal fluid. This method is neither safe nor healthy, the entire nervous and psychic mechanism of coitus being disturbed by the act of withdrawal. The act should be, in the main a reflex one, and in this method, during the entire act of coitus, the mind is engaged in thinking of exactly the right moment to withdraw the penis. It is not difficult to realize that this method of contraception tends to upset the nervous system of the man and the woman, resulting in varied nervous manifestations, as well as not giving complete satisfaction to either partner and leaving both suffering from an incomplete and frustrated sexual act.

Investigation has shown that a leakage of seminal fluid containing spermatozoa takes place prior to ejaculation, so that even if the man withdraws before ejacultaion, impregnation can take place. Besides, the majority of men do not have the self-control to interrupt the sexual act at the orgasm. Some physicians assert that men can attain full control of themselves after a certain time. This neglects the fact that there is a leakage of seminal fluid which is involuntary and also presents the question: 'How many children may be born before this ability is reached?'

Thus it is apparent that coitus interruptus is unsafe, abnormal, and unhealthy, and should not be used except under exceptionally extenuating circumstances.

COITUS RESERVATUS

This method consists of a prolongation of the sexual act without ejaculation of seminal fluid, with orgasm for the wife if desired, and gradual subsidence for the male. That it cannot be learned by most men and is therefore not a feasible method, is quite apparent.

CONDOM OR 'SAFE'

Condoms are sheaths made from rubber (so-called 'liquid latex') and skin (so-called 'beetle-' or 'fish-skin'), the former of which is much less reliable, but much more inexpensive and so the much more in use. There is considerable risk associated with the rubber condom due to defects in the rubber as a result of imperfection in manufacture, drying through age, or lack of knowledge as to the correct method of using it. Before using the condom it should be tested with air or water to make certain it has no hole. It should be lubricated on the external surface with vaseline before using, as the dry condom may be not only very irritating to the vaginal wall, but is more easily broken, especially if the introitus of the vagina is small. Space should be left at the distal end of the condom, when applying it, for the seminal discharge, a factor often neglected and a frequent cause for tears.

A professor in a German clinic says about condoms, "From the point of view of prevention a condom is as thin as a cobweb; but from the point of view of the joy of the sexual act it is as thick as the wall of a fortress." Nor is this statement an exaggeration. Condoms tear, leak, and slip off. Some men even use two condoms at once for additional protection. It is hardly necessary to state that sexual union under such conditions is highly unsatisfactory.

Safety is assured only when the condom is supplemented by other methods, the one preferred being a spermicidal agent inserted into the vagina before coitus to destroy any spermatozoa which might be liberated. The use of the condom supplemented by a spermicidal agent, is advocated when:

1. Other methods cannot be readily prescribed or are impracticable, as in the case of newlyweds where the wife has a small introitus and hymen.
2. Venereal disease is present in either partner, or one of them has been exposed to it.

DOUCHES

Many women injure themselves through failure to master the technique of douching. The fountain syringe of two or three quarts capacity is best used for this purpose. The bag should be filled with a warm solution, as douching with a cold solution is not advisable. The advantage that time and work are saved by the use of a cold solution is counterbalanced by the fact that a cold douche causes the vaginal mucosa to contract so that some of the semen may be kept in the folds and not exposed to the effects of the solution. Furthermore, sudden cooling off of the congested tissues may be harmful and a cause of pelvic pain and other disorders.

Douches should always be taken lying down. The vaginal nozzle should be introduced into the vagina and moved around so that the solution reaches all parts of the vagina.

Solutions which may be used are:

1. Boric acid—2 tblsps. to 2 qts. of water.
2. Lysol—1 tsp. to 2 qts. of water.
3. Creolin—¼ tsp. to 2 qts. of water.
4. Sulpho-naphthol—¼ tsp. to 2 qts. of water.

Salt, sodium bicarbonate, and other alkaline solutions must not be used as they may support the life of the spermatozoa.

The much-advertised whirling-spray, a large heavy rubber-ball from which the solution is squeezed by hand

through a nozzle into the vagina is unreliable since it holds an insufficient quantity of solution. It may be effective if strong spermicidal agents are used, but these are harmful to the vaginal mucous membrane and may cause poisoning.

Shock or faintness when fluid is squirted into the vagina, or more commonly cramp-like pains, discomfort from the temperature of the douche or the nature of the ingredients, are of frequent occurrence. The method is, in addition, absolutely unreliable when used alone to prevent conception. The spermatozoa can enter the uterus during coitus or while the douche is being prepared. Douching by itself is therefore not to be recommended as a means of contraception, but in combination with other methods is helpful.

SUPPOSITORIES, FOAM TABLETS, AND JELLIES

The basic principle of these contraceptives is the introduction of spermicidal agents, (which are not injurious to the vaginal mucous membrane) deep into the vagina near the cervix **before** intercourse where they will mix with the ejaculated semen and by their chemical action destroy the spermatozoa before they reach the cervical canal. Their work is futile if the penis comes directly in contact with the cervix and ejaculation takes place directly into the cervical canal.

The chemical agents most in use are:

1. Quinine—5 to 15 grains to an ounce of cocoa-butter.
2. Boric acid—3 to 4% solution.
3. Salicylic acid—1 to 2% solution.
4. Formaldehyde—1:1000 solution.
5. Chinosol or oxyquinoline sulphate—1 grain to an ounce.

Baker and Ranson, studying the spermicidal powers and rate of disintegration of many commercial suppositories and foam tablets, concluded that none of them is sufficiently spermicidal to encourage complete reliance in the absence of other contraceptive methods.

The suppositories are egg-shaped or globular forms which are inserted deep into the vagina where the body heat melts them. They are made of chemicals mixed with cocoa-butter or boroglycerin, those of cocoa-butter requiring at least seven minutes to melt and those of boroglycerin at least twenty minutes. Unless they are melted they are ineffective. The one most in use is the Rendell pessary which has quinine sulphate as the active ingredient. The following are for those who prefer prescribing:

1.
   Quinine sulphate gr2
   Boric acid gr5
   Cocoa-butter dr1

2.
   Chinosol gr2
   Boric acid gr5
   Cocoa-butter dr1

Each makes one vaginal suppository.

The foam tablets are chemicals compressed in tablet form to which effervescent chemicals, usually sodium bicarbonate and an acid such as tartaric or boric, are added for the purpose of spreading the spermicidal agent throughopt the vagina. The tablets must dissolve before they are of any use, and if the vagina is insufficiently moist, it may take a considerable period of time before the tablet dissolves. A popular commercial foam tablet is the Semori tablet which contains oxyquinoline sulphate as the spermicidal chemical.

The contraceptive jellies are generally considered to be the most satisfactory medium for spermicidal agents, for, in addition to immobilizing the sperms, they form a mechanical covering, to some degree, for the external cervical os, thus affording additional protection. The jelly is squeezed from the tube into the vaginal nozzle, the tip of which is then inserted high up into the vagina. By turning the key

at the base of the tube, jelly is then squeezed into the cervical portion of the vagina. The nozzle is then slowly withdrawn while still turning the key, until the tip of it is close to the vaginal orifice. The principal jellies are lactic acid jellies with oxyquinoline sulphate added, commercial forms of which are Ortho-Gynol, Leuco, Milsan, Birconjel, and Lanteen. Most of these can be obtained in outfits with cervical caps and vaginal diaphragms.

SPONGES AND TAMPONS

These are pieces of cotton, sponge, or gauze, thoroughly covered with a contraceptive jelly or soaked in a spermicidal solution, which are placed in front of the external cervical os. They are quite unsatisfactory, as the erect penis can easily push such an article aside into the posterior fornix, leaving the cervix exposed. If used at all, they should not be removed within six hours after coitus, and then only after a douche has been taken.

CERVICAL CAPS

This type of pessary is shaped like a thimble, only larger. It is so placed that it covers the vaginal portion of the cervix to keep the sperms from entering the cervical canal. The brim must fit snugly if it is to stay on, and accurate fitting can be done only by a doctor. The correct size and shape of cervical cap will obviate any rubbing or irritation of the cervix or vagina, as well as failure, which is almost certain to occur when a cervical cap is purchased from a drug-store and self-fitting attempted. Cervical caps do not need to fit like a glove, and the dome may be wrinkled after the cap is placed over the cervix so long as the brim fits well. In general cervical caps can be fitted only on that type of cervix of such a shape as to lend support to the cap.

Cervical caps are usually made of durable rubber and do not tear suddenly while in the vagina. They deteriorate slowly, in which case they become hard and brittle. Vaseline softens and distends them and should not be used; contraceptive jellies do not spoil the rubber. Such a cap can last a year or more, provided a new size is not needed and good care is taken. After removal from the vagina, the cap should be washed in warm or cold water, dried well, and powdered, before being placed in its container.

The first and highly important step in learning to use the cervical cap is the identification of the cervix by its knob-like shape and firmer tissue. A contraceptive jelly is applied on both surfaces of the cap, including the brim, with an extra amount being placed in its dome, which will be in apposed to the external cervical os. The cap, folded with the brim upwards, is introduced into the vagina. After it has passed the introitus it opens up and is pushed backwards and downwards as far as it will go, where it will slip over the cervix. It is necessary to feel the cervix through the dome before one can be assured of the cap being in the proper position and so of full protection.

The cap is removed by simply running the finger along the anterior wall of the vagina until the cap is reached and then easily hooked and withdrawn. The cap must not be removed within six to ten hours after coitus, and it is advisable to have a douche before doing so.

The best-known cervical caps are:

1. The French pessary, which is the one described above.
2. The Mizpah pessary which has a heavy solid rim with a slit in it into which a thin detachable rubber cap is adjusted and tied by a string which also serves for the removal of the pessary. The ease with which the cap can come off the rim makes the use of this pessary inadvisable.
3. The Pro-Race or Dr. Stopes' which has a thinner rim than the French pessary and a much longer dome. It also has a rubber loop near the rim into which a finger can be hooked to help its removal.

VAGINAL DIAPHRAGMS

This type of occlusive pessary is similar to the cervical cap in so far as it covers the cervix, but it also has a large brim which fills the vaginal vault around the cervix. The round rim of the brim is usually about ¼" thick and is made of either hard or soft rubber, enclosing in some cases a spring.

Vaginal diaphragms are used to advantage:

1. where the uterus is anteverted;
2. where the cervix is lacerated, distended, or otherwise distorted so as to prevent it being covered snugly;
3. where the woman is unable to learn the use of the cervical cap, for the Ramses and Mensinga pessaries are very easily inserted and removed.

They are used and cared for in a manner similar to the cervical cap. The common types of vaginal diaphragm are:

1. The Ramses, which consists of a coiled circular steel ring at the base of an arched rubber dome;
2. The Mensinga, which has a flat steel watch-spring instead of a ring;
3. The Dumas, which is made entirely of rubber in the shape of a shallow saucer;
4. The Matrisalus, which is shaped like a humped ellipse with a rubber dome;
5. The Rantos, which is a minor variation of the Ramses.

CERVICAL STEMS AND INTRA-UTERINE RINGS

These pessaries probably act as abortifacients through interfering with nidation of the fertilized ovum and also by stimulating the uterus to contract and expel its contents at an early stage in the development of the ovum. These pessaries are not as reliable as the cervical caps or vaginal diaphragms, reports having been made of extra-uterine pregnancies with both the intra-uterine silver spiral (Gräfenberg) and the silkworm pessaries, and of a normal pregnancy and delivery in a patient with the silkworm pessary embedded in the amniotic fluid.

These pessaries frequently cause irritation which tends to light up old inflammatory conditions and may possibly lead to cancer, as has been reported. A great many women suffer marked discomfort from this type of pessary, but its widespread popularity is probably due to the fact that once adjusted the pessary may remain in situ for a period of time.

The common types are:

1. The gold-spring or wishbone pessary, which consists of a circular perforated cap attached to a wire-spring about an inch long and ending in two prongs in the shape of a wishbone.
2. The silver or Gräfenberg ring, which is a coiled, pliable spiral of fine silver wire.
3. The silkworm pessary, which is an intra-uterine device.

To insert the gold-spring pessary the prongs are covered (and thus kept tightly together) by a gelatinous capsule, which after insertion into the cervical canal, is dissolved by the body heat, releasing the prongs, which spread out and press into the tissues comprising the cervical canal. The rings and silkworm pessaries are inserted by uterine sounds.

THE OGINO-KNAUS 'SAFE PERIOD' THEORY

There has been evidence brought forward to suggest that birth control based on the "safe period" can be employed with a reasonable assurance of sterility if certain criteria are rightly adhered to. These criteria are:

1. Observation of the menstrual cycle over a minimum period of eight months to one year. Any variation beyond a maximum of ten days renders the scheme unreliable.
2. The fertile period extends from the nineteenth to the twelfth day be-

fore the first day of the next period, when the cycle is constant from month to month.

3. Where any variation in type exists, the difference in days between the minimum and maximuum cycles occurring during the period of observation, is added to the beginning of the fertile period as based upon the maximum cycle.

4. Adjustment may be required after childbirth or abortion, after physical or psychic shocks, after febrile or debilitating diseases, and after any drastic alteration in the routine ways of life.

Although this method of contraception is highly favored by some authorities, it is generally agreed amongst scientific workers that the claims of Ogino and Knaus have by no means been proven. In addition, this method requires strict abjurement of sexual intercourse during the period of possible conception,—self-control is a human factor, and to err is also human.

BIOLOGICAL METHODS OF CONTRACEPTION.

The use of various hormones and spermatoxins as a reliable method of contraception is as yet in the experimental stage, and to-day the results are not encouraging.

Summary and Conclusion.

1. A study of reports emanating from various Birth Control clinics in the U.S.A. suggests that the best method of contraception is the use of the vaginal diaphragm (or cervical cap, if indicated) supplemented by a contraceptive jelly.

2. The condom with a contraceptive jelly is to be used only under certain conditions. If the condom breaks, a douche must be had at once.

3. The market is deluged with many devices which should be weeded out.

Much fundamental work is needed before we can claim to possess the knowledge required for the establishment of contraception on lines which are capable of being applied with certainty by the participants, and of being recommended with confidence by the medical profession. The methods advocated are a bit troublesome and may give some discomfort, but if methodically and faithfully used, they assure safety with little expenditure of energy, certainly with less work and responsibility than is inflicted by undesired children.

The author wishes to convey his sincere appreciation to Professor W. A. Scott for reviewing the paper and submitting many helpful critical comments.

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719

BONE TUMOURS. PART IV.*

OSTEOGENIC SARCOMA

By JOHN L. CATHIE, '37.

This is the most common and incidentally the most malignant of bone tumours.

The osteogenic cell, as outlined in Part I, is a multipotential cell and it is claimed that both in the cellular structure of periosteum and of endosteum these cells are present ready to differentiate as the occasion demands, for growth in earlier years or for active bone repair at any age. Thus we have two points to remember in considering the pathology of this tumour:

(a) The ability of the undifferentiated mesenchymal cell to differentiate into osteoblast, chondroblast or osteoclast, with the presence also in periosteum and endosteum of fibroblastic cells.

(b) The process of normal bony growth and repair, the laying down of fibrous and cartilage tissues, with subsequent resorption and replacement by bone.

Hence, we have a reason for the variegated pathological picture in possible cellular and tissue combinations, as well as tendency of a tumour towards the osteoblastic or bone-forming type or prevalence of bone-destruction—the osteolytic group.

Classification.

Kolodny, Codman, Geschicter and others have attempted to formulate a classification, and the Bony Registry classification is an extremely valuable adjunct to the question of bone tumours. For practical purposes one given by Dr. Robinson is very useful:

(a) *Osteoblastic.*

Periosteal Type, i.e., definitely proliferate.

(b) *Osteolytic.*

(1) Endosteal Fibro-sarcoma.
(2) Chondro-sarcoma.

The picture of tumour formation is a bizarre one of lysis with synchronous growth, proportions of each varying in any one picture and from field to field and with either predominant. For this reason the division into Osteoblastic and Osteolytic types is purely arbitrary.

Etiology.

Trauma—is given as a common history but not so commonly as in Ewing's Tumour. It is pointed out that sites of predilection generally conform to parts most exposed to trauma but that trauma might act as an indicator of presence of tumour rather than causal agent.

Radio-Active Substances—osteogenic sarcoma may develop in those whose bones become highly radio-sensitive. Boyd quotes an instance where, in a group of girls who died from the ultimate effects of swallowing highly radio-active substances whilst painting the dials of luminous watches, 27% of the deaths were due to this tumour.

Inclusion Theories and Endocrine influences.—Osteogenic Sarmona is primarily a disease of the young and while there is no age entirely immune, the incidence predominates in the second decade of life. There is no authentic case on record of a congenital osteogenic sarcoma. The fact that osteogenic sarcoma developes most frequently during the period of the most active skeletal growth and the period of skeletal puberty has long been a basis for the inclusion theories of endocrine influences. Kolodny's conclusion from statistics of the Registry of Bone Tumours is, that ener-

*The fourth in a series of six.

getic bone growth with its underlying endocrine influence is a signal factor in the etiology of osteogenic sarcoma.

Sites of Growth.

Whilst most bones of the skeleton may be the seat of osteogenic sarcoma they are, however, met especially frequently in the long bones, the metaphyses being the seat of predilection. 72% of all cases occur in the lower extremity and 82% of these are found in the region of the knee.

The bone most frequently involved —the femur, with its 52% of all cases, has its seat of predilection in the lower metaphysis. It is important to note that about 9% of all cases in the femur are located in the shaft of the bone without any gross involvment of either end, since this location is usually taken as a point indicative of Ewing's Tumour.

The second most frequently involved bone, the tibia, averages 20% of all cases, 90% of these cases involving the region about the upper end of this bone. The tumour is seen mostly on the internal aspect and never at the lower end and rarely on the lateral espect.

The humerus carries about 9% of all cases of osteogenic sarcoma, the vast majority being found in the upper third of the bone, very frequently about the sertion of deltoid. In the pelvis with its 5% incidence, the site is most frequently in the ilium, usually about the crest.

The fibula is usually involved at its upper end. In shoulder girdle, the scapula is the chosen seat, especially about the glenoid fossa; the ulna at its proximal end. Only the large bones of feet and hands are occasionally affected, phalanges remaining free. The skull is affected mostly in children and the upper jaw much less than lower jaw. The vertebrae are very rarely the seat of a tumour and no case has been reported of a patellar osteogenic sarcoma. It is worthy of note that, since the lower extremity is so markedly affected, the hypothesis was made that this was due to physiological stress and strain, yet the vertebrae are under higher stress and strain, and sarcomata here are rare. Finally in considering the rôle of energetic skeletal growth one remembers the lower epiphyseal end of femur and the upper of the tibia are the last to ossify in the human being, remaining in the growing stage until the first years of the third decade.

Pathology.

It has been suggested that the main point distinguishing this tumour from all other tumours is its visible variety of intercellular matrix. Based on this observation, division has been made into—chondromyxomatous, fibromyxomatous, sclerosing, and telangiectatic types.

The *gross appearance* depends on the stage of growth. The chief complaint often is an intractible, disabling swelling which is not painful. When the tumour is well developed there is a fusiform mass, commonly at the end of the bone, which fades away on the shaft, giving a "leg of mutton" appearance. hard to the touch and obviously part of the bone.

At first the disease is confined to the bone with involvment of the shaft, the medulla and periosteum, but in the end stages the periosteum is perforated with rapid dissemination of the growth in the soft parts. While attempts have been made to separate this tumour into two main types, depending on its bone-destruction or bone-forming qualities the usual pathological picture shows a coincident absorption and deposition of bone; the original shaft is absorbed but tumour bone is laid down in the subperiosteal space by the osteogenic cells. The periosteal type provides much controversy. The pathology department here, believe this type is not really a potentially malignant type but arises from the outer fibrous layer of the periosteum, adheres to bone and eventually invades bone. Since it sometimes forms bone it is placed in the osteoblastic group. It is interesting to note that the Giant-Cell Tumour is essential-

ly destructive whilst the definitely malignant Osteogenic Sarcoma has a marked tendency to form new bone. This formation is quite patchy, however, so that pathological fractures are prone to occur in the later stages. As the periosteum is raised from the bone by the tumour the vessels which enter the shaft from the periosteum are drawn out in parallel vertical lines, which form a scaffolding on which new bone is laid down. Fine spicules are therefore found radiating out from the central mass and in the X-ray picture give a characteristic "Sun-Ray" appearance.

The consistency of the tumour varies with the amount of bone formed and predominance of intercellular substance. Thus the tumour may be very soft, firm and fibrous, or hard and bony in consistency. The "Telangiectatic Type" is differentiated by a great abundance of blood-vessels, and believed very malignant, since such adequate provision is made for dissemination of metastases.

The usual colour of the tumour is grey but the tumour may be highly vascular and haemorrhagic with blood-filled cysts, giving the red colouration.

There is no typical picture diagnostic of a section of Osteogenic Tumour—the picture is so varied from field to field. One sees a multiforme, very bizarre picture of mixed osteoid and cartilage tissue with fibrous bands, the whole often quite indistinguishable from a section at site of a healing fracture. Three types of cells are seen:

(1) Most common and characteristic —a small spindle-shaped cell with hyperchromatic nucleus and poorly defined protoplasm.
(2) Large spindle-shaped to polyhedral cells.
(3) Giant-cells are often present—mononuclear or with a small number of small nuclei—but not foreign body giant cells.

The intercellular substance, as indicated earlier, is important in diagnosis and, like the cells, varied in type and distribution. It may be hyaline and fibrous, cartilaginous, myxomatous, osteoid or osseous, or a mixture of any.

Calcium is present and recognized by its staining quality.

Like all sarcomata, the main spread of metastases is via thin-walled blood-vessels to the lungs. Tumour cells may form the vessel walls. Should emboli pass the pulmonary capillaries lodgment may take place in other organs as well.

For this reason, the limb should be handled with care when biopsy is being done or at operation.

Preliminary radiation diminishes this danger considerably.

It is important to note that secondaries in other bones are rare, distinguishing it from Ewing's Tumour or Multiple Myeloma. Lymph Nodes are occasionally involved but any involvment is usually inflammatory. Local invasion is marked, the tumour spreading rapidly through the soft parts, and stretching the skin.

Diagnosis.

Accuracy in diagnosis and effectiveness in therapy are directly in proportion to the carefulness, experience and judgment of the combined consulting group-clinician, radiologist and pathologist. On a debatable diagnosis the clinical features are not to be outweighed by the microscopic interpretation. It is not possible for the pathologist to pass judgment in all cases. In a review of some of the atypical and unclassified cases of the Registry it is interesting to note the lack of authoritative assertiveness in the opinion of most experienced pathologists. Quoting Dr. Ewing (Biopsy in Bone Sarcoma), "The biopsy should be the last step in the diagnosis of bone sarcoma."

The recognition and treatment of the benign bone lesions offers few difficulties to the surgeon of average discernment and skill. The malignant bone lesion with its predictable ont-

come demands from the patient and the physician prolonged courage and fortitude. The intermediate or suspicious bone lesion demands a keen judgment, close study of all available facts in this and similar lesions, capacity to act without haste and ability to consult intelligently with men of greater and even of less experience.

Examination should include the complete history, both personal and family, a physical examination, local and general, X-ray and clinical laboratory examinations, including urine examination or Bence-Jones reactions and excess calcium content. The biopsy comes last and should rarely, if ever, be an emergency method.

The *prognosis* is very bad although the Bone Registry quotes 5 and even 7 year cures. The younger the patient the worse the outlook. Preliminary restraint by radiation followed by radical amputation or disarticulation offers the best prognosis.

Treatment.

An English surgeon claims cure by not only doing a disarticulation at the hip, but also an inclusion of part of the bony pelvis, using fascia and muscles to fill in the gap. Most surgeons would hesitate to perform such a radical operation.

Coley, by means of his serum, claimed many cures. Other clinics, using Coley's Serum or a modification of it, were unable to secure any encouraging results whatsoever.

Drs. A. C. Hendrick and E. F. Burton of the University report in Canadian Medical Association Journal, Oct., 1935, two cases of unquestionable osteogenic sarcoma treated by colloidal arsenic. Films were taken by Dr. Singleton from time to time during the course of treatment. These films showed a gradual and permanent improvement in the lesions and no evidence of the appearance of metastases.

The Bone Tumour Registry, however, with thousands of cases to study, report that whilst the average expectation of life in a patient is about one year—they have a certain percentage of cures extending from five to seven years. In their apparently most successful cases the procedure of choice was a thorough preliminary radiation, an adequate amputation followed by careful check-ups and further rediation therapy. As treatment rests at present this seems to be the one offering most hope.

BONE TUMOURS: PART V*
MULTIPLE MYELOMA

BY WALTER W. SNELLING, '37

Myeloma is a rare bone tumour favouring more the midportions of the long bones, especially of the humerus, femur, and flat bones of the skeleton such as sternum, ribs, skull and vertebrae. The tumour varies in size from that of a bean to that of an orange and spreads along the marrow-cavity replacing the normal bone marrow elements. The tumour expands in the transverse diameter of the bone and produces a circumscribed, well defined destruction of bone. The cancellous and cortical bone is melted away and the tumour protrudes beneath the periosteum. The periosteum forms new layers of bone, which in turn are destroyed by the advancing tumour. The periosteum may become perforated and the tumour infiltrates the surrounding structures. This weakening of the bone may lead to deformity from weight bearing or to spontaneous fracture.

*The fifth in a series of six.

Pathological Picture

The gross specimen usually shows a greatly thinned cortex of expanded

bone filled with increased medullary substance, soft or firm, translucent or opaque. The colour is grey, reddish grey or deep red, depending on the vascularity. The vascularity may cause pulsation of the tumour. Haemorrhage is frequent, leading to cyst formation and pigmentation. The microscopic picture shows the majority of myelomata to be composed of non-granulated mononuclear cells with opaque basophilic protoplasm, closely resembling the plasma cell, rounded or polyhedral, and with an eccentric nucleus. Many of the cells may contain two or even three nuclei, these cells being larger than their neighbors.

Etiology

Some authors believe myelomata are composed of cells merely representing various stages of anaplasia of a single cell type. Ewing thinks that the myelocytoma is of a more active growth than the plasmacytoma and suggests that a greater degree of anaplasia may lead a plasma cell to become a cell resembling a myelocyte. The general trend of opinion favours the origin of the plasma-like cell from the lymphocyte or from endothelium.

Clinical Course

Multiple myeloma is seldom recognized early and extensive destruction of bone may have taken place. Males between 40 and 60 years of age, are mostly affected. Myeloma in advanced stages extends through most of the bone and has been considered a multiple lesion originating and developing in multiple foci, only one case of a single lesion being recorded. Rheumatic pains of increasing severity, usually in the back or lower limbs, discovery of a tumour by the patient, sharp pains following exertion, fracture after injury, and general weakness with anaemia are the cardinal features marking the onset. As the disease progresses, gradual collapse of the spine permits the lower ribs to sink. The patient stands with a protruding abdomen, flaring ribs and shoulders back and feet wide apart in order to keep his balance. Involvement of the spine and ribs is accompanied by radiculitis, paraplegia, and emphysema of the lungs. A nephritis with non-protein nitrogen retenion and low blood pressure, associated with an albumose in the urine, called Bence-Jones bodies, is present in from 65 to 70 per cent of cases.

Diagnosis

The roentgen examination of the tumour is characteristic and shows numerous rounded, punched-out areas of varying size in more than one bone. The ribs present a mottled appearance. Pathological fracture occurs in 62% of cases, a rib being most often affected. There is no new bone formation. The lungs are almost never involved; the liver and spleen are occasionally. The spleen is often enlarged even when no metastases are present.

Prognosis and Therapy

The average duration of life after recognition of the disease is two years, though cases are on record in which ten years or more have passed between the clinical onset and death.

The myeloma responds to roentgen irradiation because of its lymphoid cellular element. The local growths disappear with repeated radiation. Amputation has been considered in cases of solitary myelomata and some observers say it postpones and may prevent metastases. X-Ray radiation is the most valuable mode of therapy — alleviates the symptoms and may prolong life.

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BONE TUMOURS—Part VI

CONDITIONS SIMULATING BONE NEOPLASMS

BY W. M. McCUTCHEON, '37

In writing the final article of this series. I propose to refer quite briefly to a few conditions of bone, which should be kept clearly in mind when considering the differential diagnoses of any condition simulating a neoplasm of bone. Unless consideration is given to these other conditions of bone, the correct diagnosis in a given case may often be missed, and consequently the proper method of therapy will not be instituted. The clinical application of the facts presented in the previous articles of this series may therefore be enhanced by a consideration of these non-neoplastic diseases.

Acute Osteomyelitis

This conditions, which is usually seen in childhood or adolescence, presents the picture of toxicity indicative of an acute infection, with localized pain and tenderness near an epiphysis, without involvement of the neighouring joint. There is a brawny swelling of the soft parts. A fever of 103-104 degrees F. and a leucocytosis of about 20,000 are commonly present. X-ray examination is negative until bone changes take place, which usually requires about three weeks.

Very rarely an osteogenic sarcoma may tend to simulate acute osteomyelitis by an acute onset of pain near the end of a long bone, accompanied by a fever of 100 to 101 degrees F. A rather firm tumour mass may be palpated, although occasionally it may feel quite boggy. Under such circumstances, surgery would likely be resorted to and would usually differentiate the conditions. The finding of pus would rule out sarcoma, but if such is not seen, the material should be studied microscopically for sarcoma and bacteriologically for organisms. The finding of necrotic bone in extremely vascular tissue favours osteogenic sarcoma. The X-ray appearance would be distinctive for sarcoma at this stage, showing the two elements of bone destruction and new bone formation, existing in the widest variety of combinations.

Tuberculosis of Bone

This condition often presents a most difficult problem in the diagnosis of a "bony swelling", and in many cases a biopsy is essential before the differentiation is complete. This is usually seen in juveniles, but is not infrequent in older people. The bone lesion is secondary to a tuberculous conditions elsewhere in the body, and always leads to involvement of the nearby joint. Chronicity and deformity are its outstanding features. The systemic features of tuberculosis, such as loss of weight, afternoon fever or evidence of tuberculosis elsewhere, aid in the diagnosis. The tuberculin test is of doubtful value. Culture of the joint fluild may show acid-fast bacilli. It is important to observe if there is evidence of involvement of both bones taking part in the joint structure. This never ocurs in sarcoma. X-ray may establish the diagnosis, but if it fails, biopsy should be used.

Syphilis of Bone

Although infection in bone by the Treponema pallidum may be congenital, it is usually a secondary or tertiary manifestation of acquired disease. The infection being blood-borne commonly occurs in the centre of the bone. The secondary lesions are usually transitory and leave no permanent effect. unless a regenerative osteoperiostitis supervenes and a raised localized no-

dule of hard subperiosteal bone persists. The early involvement is a periostitis of such bones as cranium, ribs, sternum, and tibiae, which clear up readily on anti-syphilitic treatment. In the later stage, gummata form in relation to such a lesion, causing an apparent bowing of a long bone with roughness and a nodular character to the surface. These tertiary changes are most evident of the central part of the shaft of the bone, the corresponding bone on the opposite side being usually affected later. These latter facts differentiate the condition from sarcoma. A history of exposure to syphilis, a genital sore or a positive Wassermar reaction are valuable in a diagnosis An X-ray examination should be made. The night pains, referred to the bones, help in the diagnosis but are not pathognomonic.

Brodie's Abscess

This is a single area of bone destruction due to latent chronic infection in the cancellous tissue at the extremity of a long bone. In most cases there is a history of previous acute osteomyelitis, the present complaint being of an aching pain in the end of a bone, especially after use, with swelling of the neighbouring joint. There is usually a point of tenderness over the affected area of bone, the latter presenting a fusiform swelling.

Where previous evidence of an ost eomyelitis is lacking, the condition is very difficult to diagnose without an X-ray, due to frequent close resemblance to a periosteal or central bone sarcoma or to a myeloma. A good X-ray will differentiate the condition, the abscess appearing as an area of central rarefaction in the metaphysis, overlaid by dense expanded cortex. This X-ray picture differs from that of a bone cyst, which is larger than a Brodie's abscess and is surromded only by a shell of bone.

Osteitis Deformans

This condition, which is commonly referred to as "Paget's disease", is seen in middle or late life and is characterized clinically by a thickening and bowing of the long bones and a frequently noted increase in the diameter of the head. These changes are consequent to a replacement of the normal by a more massive and less dense type of bone. There are really two stages in such a process, a decalcifying osteitis, which accounts for the deformities of the bones, being followed by a laying down of bone which is characteristically porous and chalky in appearance. The most commonly affected bones are the tibiae, femora, skull bones, vertebrae, and pelvis.

X-rays typically show the smooth, thickened, rarefied cortex and the numerous trabeculae. This picture is distinctly different from the irregular margins of the cortical zone seen with carcinomatous metastases. Involvement and bowing of the tibiae are common in Paget's disease but rare in metastatic carcinoma.

There is a great tendency for sarcomata to develop in the affected bones, and when present, the X-ray shows evidence of ossification or the characteristic appearance of endosteal tumours.

Osteitis Fibrosa Cystica

This disease of bone appears in adolescents about the time of puberty, some investigators wondering if it might not be the early manifestation of the disease which has osteitis deformans as its late picture. Evidence to confirm such a belief is lacking. The less extensive forms are characterized by rather complicated cysts which resemble giant cell tumours.

The condition may be localized or generalized. In the former, a single cyst is detected in a long bone, following pain or a pathological fracture. It is interesting to note that in these cases where the fracture has taken place through the cyst, not only does the fracture readily re-unite, but the cyst is cured in the process, and the bone rarely shows further signs of the disease.

The generalized type of osteitis fibrosa is uncommon. It may affect any bone and is a slowly progressive disease. This form differs from the localized type in that there is parathyroid abnormality. This latter may be an adenoma or a simple hyperplasia. The calcium in blood and urine is greatly in excess of the normal. Removal of the parathyroid swelling usually cures the condition.

New periosteal bone is not formed, but a shell of cortex is always retained. This fact is of great practical importance in differentiating this condition from osteogenic sarcoma. The cysts may contain fibrous tissue or clear or brownish fluid.

The aim of the writers of the articles in this series has been to present the facts relating to bone tumours in the form most desired by the student. It is hoped that the reader will approach with increased interest the investigation of a case of "tumour of bone".

GASTRIC CARCINOMA

By A. FELDMAN, '37

Very few conditions are attracting more attention to-day than cancer.

Recent statistics indicate that the stomach is the commonest site for malignancy in both sexes. Thus gastric carcinoma is certainly worthy of consideration.

Incidence

Carcinoma is a common disease. It ranks next to heart disease as the most frequent cause of death in the United States—100,000 deaths annually or 10 per cent of the total mortality. Approximately 30 per cent of these deaths are due to gastric carcinoma. This places it in the same class as broncho-pneumonia and coronary disease. Of all the gastro-intestinal tract malignancies 50 per cent are located in the stomach.

Sex: The incidence in males is approximately twice as great as that in females.

Age: The majority of cases occur between the ages of forty and sixty. It is not rare in younger patients and when it does occur, is usually more malignant.

Race: No race is immune. The incidence appears to be slightly lower among the coloured race. (Dublin).

Symptomatology.

Moynihan emphasized that there are "no symptoms pathognomonic of (early) cancer of the stomach; the symptoms are suggestive, not conclusive." The symptoms are diverse and can be considered from several points of view.

A.—IN RELATION TO THE AREA AFFECTED. (WALTON).

1. Lesser curvature, 46 per cent.
   (a) Sudden onset of symptoms 9 per cent.
   —Pain 7 per cent; haematemesis 1 per cent; perforation 1 per cent.
   (b) Insidious onset of symptoms 17 per cent.
   (c) Developing on gastric ulcer or change in symptoms 20 per cent.
2. Obstructing pylorus 39 per cent —distension, vomiting, visible peristalsis.
3. Obstructing the cardia 5 per cent —dysphagia.
4. Elsewhere in the stomach 10 per cent.

B.—IN RELATION TO THE CASES AS SEEN ON THE SURGICAL WARDS. (MOYNIHAN).

1. Simulating duodenal ulcer.
2. Mild symptoms of dyspepsia.
3. Early symptoms of obstruction.
4. Haemorrhage.
5. Perforation.

C.—IN RELATION TO THE UNDERLYING PATHOLOGICAL LESION.

Graham emphasizes the importance of obstruction in the production of symptoms. Most cases fall into one of two clinical types:

1. In the first group the ulcerated area is small in proportion to the whole tumor bulk. Obstruction is mechanical in origin due to the bulk of the tumor. This type is insidious in the onset and well-established before the patient is conscious of any symptoms.

2. Here the pathological picture is reversed, the predominant factor being the ulceration, surrounded by a very small area of induration. Obstruction is spastic, the result of muscle spasm caused by the peri-malignant inflammatory reaction. As will be discussed later, in its early stages, this type simulates benign gastric ulcer.

D.—IN RELATION TO THE ORDER IN WHICH SYMPTOMS APPEAR.

Under this heading the symptoms will be discussed in detail.

1. *Epigastric discomfort.* Long before pain occurs the patient complains of an indescribable feeling of abdominal discomfort. He is not always able to localize the area of discomfort. He often thinks that "gas" is responsible for his symptoms and says that if he could belch he would be relieved.

Periodicity of symptoms may occur in the early stages, simulating benign gastric ulcer. As the malinant process replaces the imflammatory reaction, there is a change from the peptic ulcer symptomatology. The discomfort becomes more severe and more constant, gradually merging into the stage of unremitting pain.

2. *Anorexia:*

Loss of appetite is often the first symptom.

Harris states that "when a man or woman of cancer age complains of a lack of desire for food (usually meat), even if there are no other symptoms, and if it cannot be explained by other lesions, the possibility of early malignancy should be considered and the patient kept under observation until the cause of the anorexia can be determined." A progressive loss of appetite, until in the later stages there is actual repugnance of food, is often observed. Probably the anorexia and feeling of fullness after meals are due to infiltration of the muscular wall by tumor cells. This interferes with the normal healthy tone of the stomach upon which the sense of appetite and comfort are dependent. Sometimes the anorexia is due in part to the fact that the patient fears that he will have to vomit later.

3. *Heartburn and eructations:* As would be expected, these symptoms are more frequent in the obstructive type of lesion.

4. *General malaise.* An early manifestation is a lowered state of vitality which may be the "post hoc" (anaemia, anorexia, vomiting) but in some cases is possibly the "propter hoc" of malignancy. The patient tires easily and becomes exhausted before the day's work is done. Often he cannot describe his symptoms but says that he knows that "something is wrong." Not infrequently such patients feel as if they have "flu." The patient who says that he has had several attacks of "intestinal flu" with or without fever, should be investigated for malignancy of the stomach. (Harris).

5. *Nausea and vomiting.* Obstruction is not essential for the appearance of these symptoms. Nausea without apparent cause is often one of the first symptoms. Early nausea is as a rule not related to eating, often being more pronounced before breakfast; but in some cases it is aggravated by eating a full meal.

Vomiting is usually a late symptom appearing in destructive cancers of the pyloric region. In such cases, the vomiting usually comes at night when the patient induces vomiting to relieve the pain. Occasionally the patient is nauseated before breakfast and cannot eat until the stomach is emptied. In a few cases, an early carcinoma may cause obstruction and early vomiting.

6. *Constipation and Diarrhoea.* Con-

stipation may occur early and be one of the first symptoms of which the patient complains. Later in the course of the disease after the hydrochloric acid-forming cells of the stomach have been destroyed, a gastrogenic diarrhoea sometimes occurs.

7. *Loss of weight.* The gradual loss of weight without apparent cause, associated with "stomach consciousness" may be an early sign; but when there is actual emaciation resulting from malignancy, the cause is usually hopeless.

8. *Pallor and Cachexia.* When the carcinoma is the cause of pronounced pallor or a lemon yellow tint of the skin, it is usually too late to hope for recovery. Occasionally a slight degree of pallor may be noted by the patient or his friends at an early stage.

9. *Pain.* Abdominal pain has been regarded as the most signifigant complaint. It is not, however, a constant symptom. Often the patient will give a history of several months of vague abdominal discomfort and ill health before the pain is recognized. Some of the most malignant cancers may not cause pain until very late in their course.

If, as in the large proportion of cases, pain is present, it usually is not related to meals but is sometimes aggravated by eating. The pain is usually more or less constant and is of a dull aching character. Nocturnal pain is commoner in gastric cancer than in most other abdominal lesions, except perhaps duodenal ulcer.

Occasionally the pain simulates that of ulcer very closely, in that by eating small quantities of bland food there is relief from the pain that occurs two or three hours after eating. Rarely the pain is of a paroxysmal character, resembling gall-stone colic. Usually the pain is circumscribed to the extent that the patient can cover the painful area with his hand, but it is rarely confined to a spot on which the patient can place a finger as in peptic ulcer. The pain is usually confined to the upper abdomen in the epigastrium or just above the umbilicus. It is to the right or left of the midline, depending upon whether the cancer is of the pyloric end or of the fundus of the stomach.

10. *Haemorrhage.* Both coffee ground vomiting (haematemesis) and tarry stools (melena) are late symptoms, except in the ulcer carcinoma type. The haemorrhage is due to ulceration of the cancer and erosions into the minute blood vessels. Occassionally, in the late stages, there is erosion into a large vessel and massive and even fatal haemorrhage is seen.

11. *Tumor.* The fact that no mass can be palpated has no bearing on early diagnosis. Usually, by the time the patient or examiner feels a mass, there is such extensive involvement of the stomach and metastases that there is little hope for cure.

Physical Examination

Physical examination offers little hope for the early diagnosis of gastric carcinoma. The significance of pallor, cachexia and palpable mass have already been discussed. Some of the late findings will be mentioned. The patient may be thin and anemic, with a drawn expression. There is a peculiar dryness to the skin and the breath has a foul odour. There may be numerous dilated veins running over the abdominal and thoracic wall. The abdomen is somewhat retracted. A mass may be palpable in the mid-epigastrium. The liver may be enlarged or a definite nodule felt. In the far advanced cases, ascites may develop. Occasionally metastases are noted around the umbilicus. Rectal examination may reveal internal haemorrhoids. A common finding in the inoperable cases is the presence of glands in the peritoneal reflection which can be felt in the cul-de-sac of Douglas at the tip of the examining finger. This has been described as Blumer's rectal shelf. Occasionally the so-called sentinel gland may be palpated. It must be understood that if one waits for the above-mentioned physical signs to appear, in order to make certain of the diagnosis, there will be a 100 per cent mortality. The diagnosis must be made

while the patient's general appearance is still good.

Laboratory Aids

There is no laboratory finding (as yet) upon which a positive diagnosis of cancer can be based; but certain findings are suggestive.

1. *Anemia.* Varying degrees and types of anemia have been found in patients having gastric cancer. Harris (1) suggests that if one would make an early diagnosis, it must be done when the patient's blood has almost if not quite, the normal haemoglobin content and when the red and white counts are within or near the normal limits.

2. *Occult blood in the stools.* Melena or tarry stools is usually a late finding; but occult blood may be found early in the course of the disease. In the later stages it is almost a constant finding. The absence of occult blood in the stools of a patient in whom gastric cancer is suspected does not exclude this diagnosis.

Achlorhydria. Achlorhydria is seen frequently in patients without malignancy. It is present in 10 per cent of the general population, is common in neurasthenia, hypochromic anemia, gall-bladder disease and is more common in pernicious anemia.

Hyperchlorhydia and normal acidity probably occur more frequently in the early stages than achlorhydra. Achlorhydria due to neoplasm is the result of atrophic gastritis which is usually a late manifestation. About 40 per cent of cases have free HCL. when they first come for help; 80 per cent of ulcer-carcinomas; 50 per cent of operable carcinomas; 95 per cent of benign ulcers. Some cases have a total acidity higher than normal due to an increase in the organic acids. Thus gastric acidity is of no significance in making a diagnosis of gastric cancer.

Lactic Acid. A decrease in the free gastric HCL permits the lactic acid-forming bacteria to thrive, thus causing an increase in the lactic acid. This may occur in gastric obstruction from any cause, particularly in the neglected peptic ulcer patients. Thus, the presence of lactic acid, while of significance, is not diagnostic.

Blood. The presence of free blood in the contents of the fasting stomach after a test meal is of value in making an early diagnosis. It must be remembered that peptic ulcer or trauma to the fauces in passing the stomach tube may account for the blood, either occult or free in the gastric contents.

Tissue. The presence of particles of carcinomatous tissue in the stomach contents has been reported. This finding would necessarily occur after ulceration, so that it could not be regarded as an early manifestation.

Boas-Appler Bacillus. This organism is probably a morphological transition from the ordinary organisms found in the mouth (leptothrix buccalis). Thus, although it is seen more often in the gastric contents of gastric cancer patients than in other conditions, it may occur whenever there is gastric retention associated with achlorhydria.

Sero-diagnosis

Various attempts have been made to diagnose malignancy on the basis of agglutinin, complement - fixation reactions and other changes in the blood. That none of the reported methods has gained wide acclaim indicates the lack of success of this approach to date. It is quite possible that beneficial results may yet develop from the experimental work of the serologist on the cancer problem.

X-Ray

It is generally conceded that in the hands of an expert roentgenologist, the positive findings of cancer of the stomach may be regarded as settling the question. Hauser advises routine flouroscopy of all patients over forty, with or without gastric symptoms, and then X-Ray of those cases with positive findings. This procedure would undoubtedly pick up many cases; but it would also give a false reassurance to many patients in whom fluoroscopy failed to reveal the lesion.

The following outline, which can be

applied to all gastrice lesions, is used at the Toronto General Hospital, in interpreting X-Ray films.

1. *Size.* There is a diminution in the size of the stomach in the scirrhous; but it may be enlarged in the obstructive type.

2. *Contour.* Filling defect is a most important sign. The surface characteristics of the protrusion may also be determined. Palpation under the screen or a film taken with a small amount of barium and compression technique may reveal abscent rugal markings representing the carcinomatous area. The presence of a niche without radiating rugal lines serves at times in differentiating malignant ulcer from benign. A niche on the greater curvature suggests malignancy. Holmes states that 90 per cent of the cases in which a niche is observed in the prepyloric region within an inch of the pyloric valve, represents carcinoma. In the late cases the cancer may cause a gross alteration in contour. (Hauser) (1)

3. *Peristalsis.* Gastric peristalsis is the function of the mucosa and not of the regular muscular coat, as it has been generally assumed. A few cancer cells only, in the superficial portion of the submucosa, fixed to the muscularis mucosa, will interfere with the function of this muscle to such an extent as to cause a "limp" in gastric persistalisis. This may be observed in a case without growth into the lumen and even with only a slight mucosal lesion. This finding is obtained by serial roentgenography (multiple films in rapid succession in the same direction).

In the fungating type of lesion with no invasion of the gastric wall adjacent to the tumor-mass, the gastric persitalsis is unobstructed until it reaches the growth. In the infiltrative type of lesion, the cells invade the submucosa and interfere with gastric peristalsis for a considerable area from the main portion of the lesion. Pyloric obstruction usually causes hyperperistalsis, but sometimes there is antiperistalsis.

4. *Pyloric function.* There may be a gaping pylorus due to infiltration of the musculature by the scirrhous tumor or obstruction.

5. *Flexibility.* There is a loss of flexibility as observed fluoroscopically during palpation.

6. *Motility.* In the diffuse scirrhous type there is rapid emptying; whereas in the obstructive type there is slow emptying.

7. *Mobility.* Fixation is a late sign.

8. *Palpable mass.* As discussed under symptomatology, when a mass is felt clinically it is too late. The roentgenologist may be able to detect a mass much earlier, due to the stomach being full with barium mixture, especially in the obstructive type.

9. *Tender point.* This sign is of more importance in the diagnosis of ulcer than cancer.

Hauser mentions a few other signs: the "halo" sign of Kirklin, widening of the space between the gas bubble and cardia and soft tissue densities in the cardia.

X-Ray findings are of great value in determining operability. A fungating growth usually offers a far better chance for surgical cure or palliation than a much smaller infiltrating growth.

It is claimed that medical therapy can cause a remission in symptoms and at times a return of the radiological picture to normal. The peri-malignant inflammation, that makes up a large part of the tumor bulk, certainly can regress. It is not likely that new epithelium can grow over necrotic carcinoma cells. Even Finsterer, with the best of X-Ray facilities, has only a 90 per cent. accuracy in differentiating between benign and malignant gastric ulcer. (3) Perhaps this is the explanation.

Gastroscopy

Gastroscopy and gastric photography are comparatively new lines of investigation which, as yet, are not being used in very many centres. Probably, with further improvements in the technique and instruments, these procedures will prove to be of real value in the diagnosis of carcinoma and other gastric lesions,

especially where the X-Ray is doubtful.

Laporotomy

Harris (1) considers that, if the patient's symptoms and laboratory findings suggest gastric malignancy, in spite of negative X-rays, a laporotomy is advisable. More conservative surgeons feel that since the few cases picked up would be balanced by the such a radical procedure is not justified.

Surgical exploration is justified when operability may be doubtful or questionable from the roentgenological viewpoint.

In some cases, even with stomach exposed, the surgeon may be unable to differentiate between benign gastric ulcer and malignancy. If there is any doubt, gastric resection is the usual procedure.

Treatment

"No patient is ever too ill, or his tumor too advanced, for some form of physical or psychic therapy." (7)

SURGICAL.

A. *Curative.* Surgical excision offers the only prospect for cure. There are many types of gastric resections. Balfour (8) favours the Billroth II. procedure or one of its modifications for most cases. He stresses certain factors of safety:

1. Adequate pre-operative preparation so as to control secondary anemia, dehydration, starvation, obstruction, etc.—transfusion, intravenous, gastric lavage.

2. Innocuous anaesthesia. Graham (3) has used with success a combination anaesthesia of preliminary hypodermic sedatives of morphine and hyoscine, analgesic gas, field block of the abdominal wall and splanchnic infiltration through the open abdomen.

3. Proper technique in the operation:
   (a) Scrupulous asepsis.
   (b) Complete excision of the diseased area.
   (c) Control of haemorrhage.
   (a) Proper restoration of continuity—anastamosis made in healthy tissue; accurate approximation; extension of the approximation well beyond the actual opening at the angles of anastomosis; avoidance of folds; no tension; some permanent suture.
4. After care.

B. *Palliative.* In many cases, where there is no hope for cure by resection, some form of palliative operation, such as gastrostomy (9) or gastro-enterostomy, will make the patient more comfortable, and perhaps prolong life.

MEDICAL

The danger of self-medication and the failure of the physician to appreciate the significance of the vague but "suggestive" gastric cancer symptoms, is stressed by many authorities. In Gatewood's (9) series the average duration of symptoms before a physician was consulted was 3.5 months, after which medical treatment was carried out for another 8.5 months before they presented themselves for surgery. By this time, 50% are inoperable. As previously mentioned, this is largely due to some cases simulating benign gastric ulcer in the early stages.

"We must remember that the major portion of the local lesion in malignant ulcers is due to the peri-malignant inflammatory reaction; hence the accepted non-operative therapy for benign ulcer, used in a malignant ulcer, will allow a subsidence of the inflammatory reaction, with an apparent cure of the patient, as manifested by temporary relief of symptoms and even negative X-Ray." (3) Every patient, relieved of his symptoms from a gastric ulcer, should be re-checked in three months, in order to rule out the possibility of malignancy.

Medical therapy certainly has a place, not only in pre- and post-operative care, but also in the inoperable cases. In the latter group, the diet should be light, then soft and in the terminal stages only fluids. Hydrochloric acid may lessen the dyspeptic symptoms. Sedatives are important in

the relief of pain. Gastric lavage will ease the obstructive symptom. Iron and liver are of value in both the operable and inoperable cases. (11)

IRRADIATION

The stomach was the first organ upon which this form of therapy was used. It has not proven to be very successful and is now reserved for certain inoperable cases.

Prognosis

Without operation. Carcinoma of the stomach, like all carcinomata, has a fatal issue in every instance in which it cannot be extirpated. The average duration of life in inoperable cases from the onset of symptoms is approximately one year.

Operability. At the Toronto General Hospital, 50% of cases were inoperable; 25 % operable for palliation; 25% operable for cure; 15% of the latter were alive at the end of five years. Clinical inoperability may be manifested by ascites; fixation of a large palpable mass; jaundice; definitely palpable metastatic involvement of the liver, of the sentinel supraclavicular lymph node (left, right, or both sides), of the pelvic peritoneum; infiltration of the umbilicus and finally extensive involvement of the stomach roentgenologically. It must be remembered that occasionally, large tumors are safely resected with a good prospect for cure. Even at operation, lymphatic glandular enlargement or fixation due to inflammation, may be misleading.

Operative Mortality. (13) The risk of partial gastrectomy rises rapidly when the recognized limits of operability are unduly extended and the resection is carried into the cardiac third of the stomach, with or without removal of all the contiguous lesions. Even in the "truly operable" cases, in spite of all precautions, the operative mortality is still quite high. In Gatewood's series of 418 cases—208 inoperable; 122 resections; 22 operative deaths. Of the surviving 100, 39% were alive at the end of five years.

Summary

It is evident that only a few aspects of this vast subject have been touched in this paper. Certain points deserve special stress.

1. Any person, especially if in the cancer age, who presents any of the "suggestive" symptoms of gastric cancer should be fully investigated, including fluoriscopy.

2. Gastric cancer can be cured—if diagnosed early; X-Ray is the best aid to diagnosis; gastric resection offers the only hope for cure; palliative operations and medical therapy add to the comfort of the incurable patient.

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"PYLEPHLEBITIS AND ITS RELATION TO APPENDICITIS"

BY DANIEL LEVY, '38

Aetiology

Pylephlebitis, as it is generally considered, is a septic inflammation of the portal system of veins and may arise from any infection of organs drained by that system. The most important single cause is acute suppurative appendicitis, although it may also complicate cholecystitis, diverticulitis, suppurating haemorrhoids and other acute infections of the intestinal tract. For the purpose of this paper, we are concerned entirely with pylephlebitis as a complication of acute appendicitis.

The average incidence of pylephlebitis following acute appendicitis in published clinical reports is 0.45%, and it is seen more often in males in whom we also find acute appendicitis more common. The patients who develop pylephlebitis show several characteristics: (1) They had chills during the early stage of their attack; (2) they were usually neglected cases or those in whom the appendix was not removed early; (3) at operation they usually had a gangrenous or acutely inflamed appendix along with evidence of thrombosis of the appendiceal veins, shown by lack of bleeding when the mesentery of the appendix was cut. One can easily understand how the infection could spread by phlebitis and septic thrombosis of the veins draining the appendix, and how the liver could be riddled with multiple abscesses from septic thrombi in its portal radicles.

Pathology

(a) **Gross**: The portal vein is found to be thrombosed and suppurative, its branches being dilated and filled either with pus or with brownish-green thrombus, and the periportal tissue infiltrated with yellow-green or slate-blue pus. The surface of the liver may show numerous small light spots, and only after section can the relationship of these suppurative areas to the portal system be recognized. The abscesses which develop around the portal vein spread and follow the branches of the vein, and early in the disease the liver lobules can still be recognized. Later, however, as the liver cells are destroyed, the abscesses run together and form large coalescent suppurative areas.

(a) **Microscopic**: The wall of the portal vein is usually found surrounded by ample, well-vascularized and oedematous granulation tissue, and its lumen filled with thrombus and pus. Further examination reveals numerous large and small abscesses originating from the branches of the portal vein, the walls of which were completely destroyed in most cases. These abscesses were walled off only by a layer of polymorphonuclear leucocytes, and outside of this a narrow zone of granulation tissue.

(c) **Relation to Liver Abscess**: Pylephlebitis and abscess of the liver cannot be considered synonymous; the latter is invariably the sequel of the of the former, but not all abscesses of the liver result from suppurative inflammation in the portal vein. Abscesses of the liver may form as a result of infection from four sources: (1) In portal vein; (2) in hepatic artery; (3) up the bile ducts; (4) in lymphatics. It is when the infection travels by way of the portal vein, that there can be the association of both pylephlebitis and hepatic abscesses. If the abscess is single and the result of septic extension from the appendiceal veins, it is almost always found in the **right** lobe of the liver.

Signs and Symptoms

1. **History** is important. Pylephlebitis comes on about two weeks after the first symptoms of acute appendi-

citis when untreated and in about one week if it is to follow operation.

2. **Chills** or true rigors are characteristic, especially repeated chills. If the chills continue after the removal of the appendix, pylephlebitis is very likely developing.

3. **Temperature Changes** accompanying the chills. The average temperature is around 103° with daily precipitous swings (98° to 105°-106°.) The temperature is usually higher than one would expect for appendicitis and then, on removal of the appendix, the temperature still remains high and septic. Chills associated with rise in temperature, occurring during an acute inflammation of any organ drained by the portal system, must be considered significant of the entrance of septic material into the liver and invasion of its tissues.

4. **White Blood Count** is not of great diagnostic importance since it varies greatly (9-40,000) but is usually raised.

5. **Liver Signs:**

(a) Enlargement of the liver seen in at least 50% of cases.

(b) Tenderness is present in most cases but usually late. One frequently finds tenderness directly over the portal vein.

(c) Jaundice in at least 50% of cases. This indicates involvement of the polygonal cells of the liver. The bilirubin content of the blood shows a progressive increase long before clinical jaundice is seen. A slight icteric tint to the sclerae may appear even before the chills and fever.

6. **Ascites** is a late sign and usually terminal, indicating obstruction to the portal circulation.

7. **Symptoms of Infection**—One or more symptoms characteristic of any infectious condition in the body are seen: Anorexia, nausea, vomiting, lassitude and either diarrhoea or constipation.

8. **X-Ray** reveals an enlarged liver manifested by a high diaphragm on the right, and limitation of its movements usually.

Diagnosis

In a typical case, the diagnosis is made by a shift of the symptoms from the appendicular region to the hepatic region following repeated chills and fever, in addition to some of the other signs and symtoms mentioned. Munro (Ann. Surg. 42; 692, 1905) has stated that "the most important clue in making a diagnosis is the recognition of the causative appendicitis." This is quite true in most cases, but one should keep in mind the fact that the original focus may be in any abdominal organ drained by the portal system. Thus, if chills are present during a developing appendicitis, we suspect that pylephlebitis may occur. If the chills continue after removal of the appendix and if there is some slight tenderness over the liver and a mild jaundice, we must consider strongly the incipient stage of pylephlebitis.

Treatment

The treatment is primarily prophylactic by—

1. Earlier recognition and diagnosis of acute appendicitis.

2. Prophylactic treatment by ligature of mesenteric veins. When the surgeon finds during appendectomy that there is no bleeding on cutting the appendiceal vein because of thrombosis, he should consider that case as one in which pylephlebitis may develop. Further, if that patient had chills and if at the time of operation a frank suppurative phlebitis in the mesentery is seen, before appendectomy, a ligation or excision of the ileocolic vein is indicated.

Braun's Operation

Braun described ligation of the ileocolic vein since this vein is the only channel through which emboli from the appendiceal vein can travel to the portal vein. Primary ligation is one done at the same time as the appendect-

omy. Secondary ligation is one done at a subsequent operation because of repeated rigors following the original appendectomy. The ligature is applied to the upper part of the ileocolic vein near its junction with the superior mesenteric vein well clear of the inflammatory area. If the thrombophlebitis has ascended beyond this point, ligature of the superior mesenteric vein proximal to the upper limit of the thrombus must be done. There is no danger to the vitality of the bowel because of the efficient collateral channels.

3. If pylephlebitis has already developed, operative intervention is of no value unless a well-defined abscess has formed, in which case the indication is for incision and drainage.

Prognosis

Once pylephlebitis is established, it runs a course of about five weeks on the average and ends fatally in approximately 90% of the cases.

Summary

Given a delayed operation in appendicitis with early repeated chills, there is great possibility of the development of pylephlebitis. By enlarging the incision the ileocolic vein region may be inspected and palpated in many cases, without danger of spreading infection. If the vein is thrombosed, it can be dissected clear of the artery and ligated, and in such a case pylephlebitis may be prevented. Many successful cases have been reported in the literature.

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SOME FACTORS IN CARDIAC OEDEMA

By T. J. POWELL, B.A., '39.

Most text books agree that cardiac oedema is in some way related to the venous obstruction present in these cases, causing a rise in venous pressure. They also agree that other factors play some part. The differences in these other factors and the extent of their participation in the aetiology is considerable. It seems fairly certain that the kidneys are not primarily at fault, even though digitalis often does give remarkable improvement, by improving the renal circulation. An alteration in the normal balance in the exchange of fluids and ions between the tissues and blood vessels, is more probable.

Starling in '95-'96 suggested that the hydrostatic pressure in the capillaries balances the osmotic pressure of the plasma in this situation. Much later Cushny found that the filtration of urine through glomeruli could only take place if the hydrostatic pressure was greater than the osmotic pressure. Previous to this, Scott showed that with a fall in blood pressure, an inflow of fluid into the vessels occurred and vice versa. In 1928 Landis proved, by direct measurements, that at the arterial end of the capillary the hydrostatic pressure exceeded the osmotic forces. This condition of affairs was reversed at the venous end. A purely mechanical factor can therefore cause fluid to be exchanged between the vessels and tissues. Wright says that the normal venous pressures in the median basilic vein, at heart level, is 10-15 cms. of water, while in cases of cardiac oedema the pressure may be 30-35 cms. of water. A number of observers have recorded this fact and some have assumed that the capillary pressure is proportionally raised. Some have likewise denied this. Bolton found that partial obstruction of the circulation through the inferior vena cava, in animals, produced an oedema, which appeared even with a normal venous and subnormal arterial pressure.

While increased venous pressure is always a concomitant to cardiac oedema, the capillary pressure may or may not be raised according to one's viewpoint. Even though an increased capillary pressure could cause oedema, some other factors must be invoked. As a result of some experiments on dogs Leiter ('28) found that oedema was a constant feature when the plasma proteins fell below 3 gm. %. The oedema fluid protein content was less than 0.25%. Thomson, in a study of normal persons and patients with myocardial disease, showed that in cases of failure without oedema the albumin fraction was slightly reduced and the globulin about normal. In those cases showing oedema, the albumin was reduced to about 60% of its normal value and the globulin slightly. In the former series of cases, the osmotic pressure of the plasma was reduced from the normal 40 mms. of mercury to 32 mms. In the oedematous cases the osmotic pressure was 25.3 mms. (These pressures seem to be high—Wright gives a normal of 25 mms. of mercury). He suggests that the low protein content of the plasma in these cases is a contributing factor in oedema and remarks that the deficiency cannot be either simple dilution (because of the different reduction in the two proteins) or renal (since there is often little or no albuminuria). He dismisses transudation of protein into the tissues, by saying that there is probably not enough protein in the oedema fluid to account for the diminution. Bramkamp found that in the oedema fluid, in cases of cardiac oedema, the protein content averaged about 0.2%. Thomson agrees with Payne and Peters in considering that malnutrition is the cause of the diminished plasma proteins. He thinks that passive conges-

tion of the liver might cause a deficient output of proteins, from that organ.

Even though the cause of the low plasma proteins is problematical, their deficiency will be a factor in the mechanism of cardiac oedema. This factor, though a nearly constant finding, must be sufficient alone. Landis has done some extremely delicate, ingenious and conveniently direct experiments on the capillaries in the mesentery of the frog. Wearn and Richards showed, directly, that the glomerular capillaries of the frog are impermeable to protein. It has been assumed that when the capillaries become dilated they become more permeable. Landis proved that this is not so, observing the rate of movement of the red corpuscles in a capillary, occluded by pressure on one end. In a mesentery bathed with oxygenated Ringer's, he found no transfer of fluid, whatever their dilation. With the Ringer's saturated with ovygen and half saturated with carbon dioxide there was no change. Full saturation with carbon dioxide gave a slight flow of fluid from the capillary. Oxygenated Ringer's with its ph varied down to 4 gave no change. Below ph 4 there was evidence of leaking out due to irreversible changes. When the mesentery was bathed with un-oxygenated Ringers there was a rapid movement of the corpuscles and they soon became packed at the closed end. This is definite evidence that the capillary wall has become permeable to proteins and more permeable to fluid. The reversible increase in permeability after oxygen lack is large. It is not quite as great as that produced by killing the endothelial cells with mercuric chloride. He assumes that an increased venous pressure would cause a stagnant anoxia. This increases the permeability of the capillaries and this is a large factor in cardiac oedema. Bramkamp says that since there is a low protein content in this oedema fluid, capillary damage is not an important factor in the aetiology.

Leaving direct experiments, a rather chatty article in the Lancet, by Raven, suggests that a factor is the breakdown of tissue proteins, giving an increased osmotic pressure. For evidence he cites the loss of weight, and even emaciation, which become apparent after effective diuresis with salyrgan. The attacks of dyspnoea in unrelieved cases is an expression of the removal of carbon dioxide, resulting from the breakdown. He would also like to know if urea excretion is above normal during the period of rapid catabolism.

If one inclines towards conjecture, many factors in the aetiology of cardiac oedema might be postulated. It seems, however, that the sequence as known at present is—that the venous obstruction causes an increased venous pressure, this gives a degree of stagnant anoxia. This causes an increased permeability of the capillary bed, especially in the dependent parts. The greater permeability accounts for the excess fluid and possibly for some of its protein content. This, however, might come from tissue break down in these regions. The low plasma proteins may be ascribed to such factors as "leakage" into the tissues, malnutrition or impaired liver function.

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EMBRYOLOGY OF THE URINARY SYSTEM IN MAN

By D. R. WARREN, '41.

The urinary system is part of the urogenital system, which as a whole presents more peculiarities of development than any other system of the human body. Its formation is complicated and perhaps difficult to understand due to its many parts and to the appearance and disappearance of them. The urinary system develops into a great complexity of ducts for carrying off waste products of the body. In man instead of one set of urinary organs forming and persisting, three sets develop in stages. Each is called a particular kind of "nephros" which is of Greek derivation and means "kidney." The three sets are: the pronephros or "before" kidney, the mesonephros or "middle" kidney, and the metanephros or "after" kidney. These develop in this order with respect to time and position in the embryonic body.

The pronephros appears functionally in the amphioxus and certain of the lampreys and also appears in immature fishes and amphibians to be later replaced by the permanent mesonephros of these forms. However the embryos of amniotes (reptiles, birds and mammals, including man) possess at first a pronephric system, then a mesonephric system and finally a metanephric or true kidney system. It is not known whether the three systems are modifications of the originally continuous organ or distinct in the lower vertebrates. It is known that in the human embryo the first and second sets of urinary organs represent systems that are permanent in the lower forms.

The Pronephros.

When the mesoderm of the embryo divides to form the somites and the unsegmented parietal and visceral layers, a series of masses of mesoderm is left intervening. These receive the name of intermediate cell masses or nephrotomes. Each nephrotome forms by its growth in length a crooked cord of cells. An evagination of the mesothelium occurs and the bud grows toward the cord. When they join a lumen begins to appear and we have a pronephric tubule resulting with an opening known as the nephrostome. The pronephric system consists of these tubules which are arranged segmentally and in pairs. One end of the tubule opens directly into the coelome or body cavity and the other into the pronephric duct. In man the pronephric tubules are present in only relatively few segments. At each side of the root of the mesentery and more medial than the nephrostome is a small elevation which projects into the coelome and probably represents a rudimentary glomerulus. It is from this that the blood releases its waste products and empties them into the coelome. They pass out through the nephrostome and pronephric tubule due to the action of cilia surrounding the funnel-shaped nephrostome. The mesonephros, beginning to develop almost as soon as the pronephros and in the same relative position, forms a ridge projecting into the coelome. In this mesonephric ridge the pronephric tubules become imbedded.

The pronephric duct begins to develop at about the same time as the tubules. Dorsally and laterally the tubules bend backward to unite with the succeeding ones thus giving rise to the duct. The duct is at first solid but it acquires a lumen. At first it lies on the outer side of the nephrotomes but later becomes imbedded in the mesonephric ridge. It extends backward from the level of the heart and finally opens into the cloacal part of the gut by bending medially. On its way back the duct passes beneath the ectoderm and above the mesoderm.

The pronephric tubules are only transient structures in man and the higher Vertebrates and have no functional significance. However, the ducts remain to become the ducts of the mesonephros. The main point to be remembered is that they are present and thus indicate recapitulation.

The Mesonephros.

This system which constitutes the second set of urinary organs also consists essentially of a series of tubules each of which is related to a knot of blood vessels at one end and to the primary excretory duct at the other.

These tubules begin to develop just caudal to the pronephric tubules and are also located in the intermediate cell mass. At the outer end the tubules open into the pronephric duct which now becomes the mesonephric or Wolffian duct. After the tubules are formed a branch from the aorta enters the new condensation of the mesenchyne and forms a structure known as a glomerulus. This structure grows against and around the tubule, which becomes flattened and surrounds the glomerulus. These tubules are more complicated than the pronephric ones and form a better system for excretion. The blood vessels do not go to the coelome but are enclosed within the glomerulus which is in turn surrounded with two layers of epithelium. In this case there is no chance of the fluid from the glomerulus passing into the body cavity and it passes directly out by the mesonephric tubules. As the tubules become coiled and increase in length they cause an expansion into the cavity. The series of these expansions forms the ridge that is called the urogenital fold. The tubules themselves divide into secondary and tertiary tubules and the majority of them lose their nephrostomes. They appear just caudal to the pronephros and gradually extend backward.

The mesonephric or Wolffian ridge is attached by a mesentery to the dorsal body wall. The peritoneum extends over the mesonephros, thus enclosing it. About this time the mesothelium on the ventro-medial side becomes thickened and forms the genital ridge. There is then formed a division in the fold and ultimately a division in the duct. The lateral division remains the mesonephric fold and the medial one becomes the genital fold, the anlage of the genital gland.

The pronephric duct begins to disappear in the male but remains in the female to form the oviduct. The mesonephros functions as the urinary system during its existence in the embryo but after a time degenerates. The primary excretory duct is important since the ureteric anlage of the permanent kidney grows from its caudal end. The duct itself is transformed into the chief genital organs of the male and its derivatives. The degeneration of the tubules is also of interest. The breakdown is quite gradual and the tubules are usually broken at the angle between collecting and secretory regions. There are thus formed two groups: the upper and the lower. The collecting portions of the upper group unite with the rete tubules of the testis or corresponding part of the ovary. In the male they form the efferent ductules of the epididymis. In the female they represent the epoophoron. Of the lower group a few of the tubules persist in the male as the paradidymis and in the female they form the paroophoron.

The Metanephros (Kidneys).

The kidneys are the third set of urinary organs to develop. They assume the functions of the mesonephros as they disappear and constitute the permanent urinary apparatus. Thus we see there are no actual "kidneys" in amphibians and lower animals.

Each kidney is derived from two anlagen which unite. The epithelium of the ureter, renal pelvis and the straight renal or collecting tubules is derived from the mesonephric duct by evagination, and the convoluted renal tubules and glomeruli are derived directly from the mesenchyme.

The three essential parts of the kidney are: the renal corpuscles, composed of glomeruli and Bowman's capsules; the secretory tubules, and the collecting tubules.

At the point where the mesonephric duct of each side makes a sharp bend to join the cloaca, the ureteric evagination appears in the form of a small hollow bud-like structure. It appears dorsally on the duct. As it grows it becomes differentiated into two parts. Its distal end expands and forms the primitive renal pelvis and the proximal elongated stalk is the anlage of the ureter. Four evaginations grow out of the renal pelvis and they are arranged, forward, backward, and two central. These are the first renal tubules. The distal ends of each enlarges and form secondary tubules, and these in turn form tertiary tubules and so on. The tubules grow in the nephrogenic tissue building up a structure which forms a cap around the pelvis and grows along with it. Instead of there being just one opening for each of the primary tubules, many develop as small openings which gradually form hollows or calyces. The promontories between are known as renal papillae. As the primary tubules develop, a cap called the nephrogenic cap is produced about each. As the new orders of tubules arise, this increases until it forms a peripheral layer about the ends of the branching tubules. The converging tops of these structures are known as pyramids with their apices at the renal papillae. The nephrogenic tissue forms the cortex of the kidney. Each subdivision is separated, giving the kidney a lobulated appearance which remains until after birth. It remains permanently in reptiles, birds and some mammals, such as the bear, the ox and the whale. The pyramids are subdivided into smaller pyramids, thus forming a very composite structure. Between the pyramids the cortex dips to the pelvis, forming the renal columns which contain the collecting tubules as cortical rays. These run parallel and converge at the papillae. The glomeruli and Bowman's capsules form the renal corpuscles and it is within these that fluid is exchanged from the blood to the collecting tubules. This fluid passes through the visceral layer of Bowman's capsule and is collected in Henle's loop. From here it passes to the collecting tubule through the distal convoluted tubule. The corpuscle is formed from the persisting nephrogenic tissue peripherally. The renal corpuscle is not at first attached to the collecting tubule but becomes so shortly after birth in the normal process. If it does not a condition known as congenital cystic kidney may result. The capsule of the kidney is derived from mesenchymal cells which surround the anlage of the organ. The cells are changed to those of fibrous connective tissue and smooth muscle which blend to form the capsule, surrounding the kidney and holding it in place.

The developing kidney reaches a position in the retro-peritoneal tissue, dorsal to the mesonephros at about the second lumbar vertebra where it remains to enlarge without changing its position. The ureter elongates as the embryo grows.

Cloaca, Bladder, Urethra and Urogenital Sinus.

The allantois appears as a bud from the ventral side of the caudal portion of the primitive gut. It grows out and becomes enclosed in the umbilical cord. The portion of the gut immediately behind the attachment of the allantoic stalk becomes enlarged and forms the cloaca. This cloaca later receives the mesonephric ducts laterally and is prolonged caudally as the tail gut. The cloaca is separated from the outer surface by the cloacal membrane.

The saddle-like portion between the allantois and the intestine grows caudally and divides the cloaca into rectum and urinogenital sinus. The division is accomplished by a ridge which grows from the lateral wall of each side to meet in the middle. It fuses with the cloacal membrane and

divides it into anal and urogenital membranes. The dorsal and smaller part is the rectum. The urogenital sinus be comes differentiated into two regions by elongation and construction. The two regions are: the vesico-urethral anlage which receives the mesonephric ducts and the allantois, and the phallic portion of the urogenital sinus.

The proximal ends of the mesonephric ducts are funnel-shaped and as the bladder anlage develops, these ends are taken up into the wall until the ureters and mesonephric ducts acquire separate openings. The ureters now open into the vesico-urethral anlage lateral to the mesonephric ducts. The bladder becomes larger and more sac-like and the allantoic duct becomes solid and degenerates to become the umbilical cord. The bladder seems to be derived from the cloaca not from the allantois. After the bladder begins to enlarge, the adjacent part of the urogenital sinus becomes constricted and the urethra begins to be formed. This constricted part represents practically the entire female urethra. In the male, however, it is only part, more developing in and with the penis. The urogenital sinus is narrowest at this point, widening farther out. The cloacal membrane ruptures and the narrow part is taken up into the wider, forming the vestibule into which the urethra opens. The prostate gland, Cowper's glands, and Bartholin's glands are formed from bud-like evaginations of the urethra.

With all these complexities of development we might imagine that the normal course of formation would occasionally be disturbed, resulting in peculiarities or anomalies of the system. It is seen that this is the case and we are not therefore surprised at their common occurrence, even while marvelling at the accuracy and efficiency with which the normal urinary system functions.

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BOOK REVIEW

The Contagiousness of Puerperal Fever.

By Oliver Wendell Holmes.

As a medical student, in 1835, Dr. Holmes wrote: ". . . I have more fully learned at least three principles since I have been in Paris: Not to take authority when I can have facts; not to guess when I can know; not to think a man must take physic because he is sick." Also, "My aim has been to qualify myself . . . not for a mere scholar, for a follower after other men's opinions, for a dependant upon authority—but for the character of a man who has seen and, therefore, knows, who has thought and, therefore, arrived at his own conclusions."

These remarks illustrate the man better than any long description, and might well be considered deeply by every student. Dr. Holmes did not practice medicine, being more interested and better suited to research and teaching, holding the chair of anatomy and physiology in Dartmouth and Harvard medical schools. In the introduction to this essay, which was published in 1843 and again in 1855, he says: "*. . . our journalists and committees have no right to take up their pages with minute anatomy and tediously detailed cases, while it is a question whether or not the 'black death' of child bed fever is to be broadcast by the agency of the mother's friend and advisor. Let the men who mould opinions look to it, if there is any voluntary blindness, any interested oversight, any culpable negligence even in this matter, and the facts shall reach the public ear, the pestilence-carrier of the lying-in chamber must look to God for pardon, for man will never forgive him.*"

He conceived the idea of investigating this disease at the report and discussion of a fatal case in Boston, in which a physician who held the autopsy confined several women during the following week, all of whom developed the disease and himself died within a week. Holmes was struck by the similarity to small pox, recognized then as a contagious disease, which became epidemic at times, and in which the severity of the attack varied.

His extensive review of the literature included a treatise by Dr. Gordon, of Aberdeen, published in 1795, in which from 77 cases, he concluded: "*I arrived at that certainty that in the matter that I could venture to foretell what women would be affected with the disease, upon hearing by what midwife they were to be delivered, or by what nurse they were to be attended, during their lying-in; and almost in every instance, my prediction was verified.*"

Dr. Holmes was able to get certain New England physicians to place at his disposal records in which they showed that at certain disastrous periods in practice they had had consecutive series of confinements in which most or all patients developed puerperal fever. Each series was initiated by the performance of an autopsy, attendance upon a case of puerperal fever, or, especially, erysipelas. Yet other doctors in the same towns had no cases of the disease. In one particularly impressive series of seven cases, the nurse tending one of them died in a few days of puerperal fever, and another nurse attending another died of erysipelas and sore throat.

Some physicians found that washing the hands and changing clothes worn on attending a puerperal fever patient broke the chain; others quit obstetrical practice for some weeks or months; one washed his hands in chloride of lime solution.

In the light of modern knowledge, we know that these are very accurate

observations, for, the relation of puerperal fever, erysipelas, and septic sore throat streptococci is so close that they are likely identical. Proof seems to have been offered recently that modern puerperal fever cases mostly arise from streptococci in the nasopharynx of doctor, nurses, or other patients near the patient.

Dr. Holmes recommended the following hygienic measures:

(i.) An obstetrician should never conduct post-mortem examination upon cases of puerperal fever, or if he does, should wash thoroughly, change all his clothes, and wait 24 hours before attending a confinement. The same precautions should be applied to simple peritonitis and erysipelas, especially.

(ii.) If a case of puerperal fever should occur in a physician's practice, he must take especial precautions before attending another patient in labor.

(iii.) If two cases of puerperal fever occur when the disease is not locally epidemic, he should relinquish obstetrical practice for one month and seek to free himself from "any noxious influence he may carry about with him." If three or more such cases occur, he is surely the vehicle of contagion.

(iv.) An obstetrician must enquire about his nurses and assistants, to see that they do not carry the contagion.

(v.) It must be considered a crime, not a misfortune, for a physician to carry contagion in the future.

An American Doctor's Odyssey.

By Victor Heiser, M.D.

The end pages of this five hundred page volume comprise a map of the world, indicating the scope and extent of the author's experience.

In May, 1889, when he was just a young lad of sixteen, the author went out to the family barn to release a fine team of horses as the flood waters of the South Fork near Johnstown were rising. A few seconds later he was riding on the ridge pole of the barn on the wall of water which erased the town when the dam broke, watching his family and hundreds of others being drowned and killed. Somehow he escaped. His subsequent history has been very much a continuation of that first riding on the crest of the wave surrounded by débris and dying people.

A chance try for a post with the Marine Hospital Service made him one of three successful applicants out of sixty odd. After some years in the immigration service at home and in Italy he was sent to the Philippines, where he served for many years as the Director of Health. His record of the struggles there with native ignorance, fortitude, and Oriental complacence, combined with the forces of cholera, plague, small pox and many other diseases are not only interesting but in-

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structive. They show how little by little the knowledge of these diseases grew through the early years of the century and how men in the field contributed.

During the great part of the book he describes his work with the Rockefeller Institute and one of the most interesting and amusing bits is that which relates his practical joke on Dr. MacCallum, the author of the excellent Pathology text. He had him appointed city Pathologist in Manila for two weeks during a cholera epidemic. This proved to be a most arduous task and the author remarked that the chapter on cholera in MacCallum's text is no doubt so good because of this.

Dr. Heiser has now retired from active service, having compiled his book from "literary trunks of old diaries, notes, etc." He remarks: "Such a career as mine has necessarily deprived me of close family ties, and many other experiences which enrich our lives." He gives us a glimpse of a rather lonely, weary person who has "walked miles of corridors in hospitals," heard endless "this is the ward for so and so," told endless sprightly stories with a hidden moral, known "the throb of engines, the mournful warning of foghorns, white-jacketed stewards, tourists vocal with erroneous information, cots, feather beds, wooden pallets." None the less we are vouchsafed a sense of humour, which is at times a triffle pompous, and bureaucratic. The only picture in the book is of Dr. Heiser; however, the illustrative wood cuts at the heads of the chapters also provide decorative effect.

We think this book should be read by all who contemplate service in public health work. It reveals its attractions and its abstractions. Most of all it points the advantage of a life of travel and change: and unwittingly the regrets of such a life.

W.R.F.

MEDICAL SOCIETY NOTES.

The Medical Society Executive has been greatly honoured by the response of the student body to all of its undertakings throughout the year. The term has been a busy, interesting and profitable one. A brief summary will bear this out.

* * *

A co-operative movement has been made with the Faculty in revising the Medical course. Students of every year have joined in expressing their difficulties. A summary of the salient facts has been prepared and will be discussed with a committee formed by the Faculty. The Medical Society will be represented at the American Medical Students' Association meeting at Johns Hopkins University in April to discuss student problems, and the information gained added to the report.

* * *

The Medical At-Home has become one of the most popular of the University frolics and was handled this year at a substantial profit. The difficulty of accommodating those wishing to attend is ever increasing. Arrangements have been made to alleviate this condition and we look forward to a bigger and better Med-At-Home in 1938.

* * *

The Daffydil Committee was unable to supply the demand for tickets, even after the performance had been extended from two to three nights last year. They turned down a motion to increase it to four nights this year by a majority of but two votes.

* * *

The open meetings had record attendances. In a course crammed with lectures, the difficulty of choosing topics interesting and valuable to first

and sixth year students alike, is by no means small. We hope they have been enjoyed by all.

* * *

The Medical Journal has improved its financial position by increasing the graduate subscription. This will assure students in the lower years of its worth. At the annual elections, subscription was extended also to B. and M. students, and the members of the fourth year in that course given the right to vote and run for office on the Medical Society.

* * *

The executive was represented at the Students' Peace Congress and its subsequently formed Continuations Committee. Because of its personal content, the principles of this body could not receive the endorsement of the Medical Society. Nevertheless, every student was given an opportunity to express his opinion.

* * *

The class of 4T2 was welcomed (at its own expense) to a banquet and dance. These were attended by many of the students of the other years.

* * *

The surplus of last year's executive was donated to the Bursary Fund and a larger surplus will be handed over to the Bursary Committee next year. The auditor's statement for this year will appear in the November issue of the Medical Journal.

* * *

The problem of establishing a book room to supply Medical books to students at reduced prices has been handed on to the incoming executive. In this and all other matters, we wish them every success.

UNDERGRADUATES!

WHY NOT WRITE AN ARTICLE FOR THE JOURNAL?

DURING the summer months which are approaching there are few of us who have not some time to spare. For those who are spending a summer away from the study of medicine—writing an article will serve as a means of "keeping in touch" with the study of your chosen field. Those men, on the other hand, who have decided to continue their pursuit of medical knowledge throughout the summer have an excellent opportunity to review any work of special interest to them. Your subject need not be scientific — provided it is of medical interest and accurate.

Our only requisites are that these articles be not too long (1,500 to 2,000 words) and that their contents, if of a scientific nature, be an accurate source of information in order to uphold the present standard of the Journal.

We request that articles be no longer than necessary to convey accurate information in good literary form. The Editorial Staff are pleased to assist you in preparing your paper. 1,500 to 2,000 word articles leave room for others to express themselves.